Bradley Man Camp Dumps Removal and

On-Site Repository

Final TCRA Work Plan

pursuant to

Administrative Settlement and Order on Consent for Removal Actions

(CERCLA Docket No. 10-2021-0034)

Prepared by:

Prepetua Resources

With revisions regarding selected design alternatives by:

U.S. Environmental Protection Agency Region 10

United States Department of Agriculture Forest Service Intermountain Region

Stibnite Mine Site

Stibnite, Valley County, ID

July 2021

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
µg/L	Micrograms per liter
%	Percent
ARAR	Applicable or Relevant and Appropriate Requirement
ASAOC	Administrative Settlement Agreement and Order on Consent
BMPs	Best management practices
CAD	Computer aided drafting
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	Cubic feet per second
CY	Cubic yard
ECO	Engineering Change Order
EFSFSR	East Fork of the South Fork of the Salmon River
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ET	Evapotranspiration
FML	Flexible membrane liner
GCL	Geosynthetic clay liner
HDPE	High density polyethylene
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IDHW	Idaho Department of Health and Welfare
JMM	James M. Montgomery Consulting Engineers, Inc.
LAIG	Land Application Infiltration Gallery Area
LCRS	Leak collection and recovery system

LLDPE	Linear low-density polyethylene
LMCV	Lower Meadow Creek Valley
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
ML/ARD	Metals leaching/acid rock drainage
MSE	Millennium Science & Engineering, Inc.
MWMP	Meteoric water mobility procedure
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOV	Notice of Violation
NPV	Net present value
OMB	U.S. Office of Management and Budget
pcf	Pounds per cubic foot
psf	Pounds per square foot
PVC	Polyvinyl chloride
QAPP	Quality Assurance Project Plan
RAO	Removal action objective
RCRA	Resource Conservation and Recovery Act
SGP	Stibnite Gold Project
SMI	Stibnite Min Inc.
SODA	Spent Ore Disposal Area
SOW	Statement of Work
SRK	SRK Consulting (U.S.) Inc.
Superior	Canadian Superior Mining Company
TCRA	Time critical removal action
URS	URS Corp.
USACE	U.S. Army Corps of Engineers
USDA-FS	U.S. Department of Agriculture Forest Service
USGS	U.S. Geological Survey

1 EXECUTIVE SUMMARY

Respectively), Idaho Gold Resources Company, LLC and Stibnite Gold Company (collectively “Perpetua Respondents” or “Perpetua”) prepared a Work Plan to guide the implementation of a Time Critical Removal Action (TCRA) at the Bradley Man Camp Dumps within the Stibnite Mining District (Site) in Valley County, Idaho (refer to Figure) and for construction of a repository to contain waste removed from the Bradley Man Camp Dumps and the Lower Meadow Creek Tailings (Perpetua, 2021). Perpetua’s work plan included identification of design alternatives. This final TCRA Work Plan has been revised by the U.S. Environmental Protection Agency (EPA) and focuses on the selected design alternative. Perpetua Respondents are implementing the TCRA in accordance with the requirements of an Administrative Settlement Agreement and Order on Consent (ASAOC) for Removal Actions with EPA and U.S. Department of Agriculture Forest Service (USDA-FS or Forest Service) (EPA and USDA-FS, 2021). The work is being conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

The Bradley Man Camps dumps (also referred to as the Upper and Lower Man Camp dumps) are a large area of mine wastes and fill of various and poorly documented origins immediately adjacent to the East Fork of the South Fork Salmon River (EFSFSR) and are a source of metals and sediment to the river. In accordance with the requirements of the ASAOC, Perpetua will conduct a TCRA to remove approximately 200,000 tons of mine waste from the dumps located within the floodplain for placement in an on-site repository that will be located on the historic On/Off Leach Pads. An additional 25,000 tons of tailings removed from Lower Meadow Creek Valley under a separate TCRA will be consolidated with the material from the Bradley Man Camp Dumps in the repository.

The repository falls within the project footprint of the Stibnite Gold Project (SGP), and materials therein would be moved to permanent development rock storage facilities in the SGP mine plan during construction or early operational periods by 2028, should the SGP be constructed. There is no certainty that Perpetua will receive the necessary approvals and authorizations to operate the mine. However, even if mining is approved and permitted, there will still be a period of time between implementation of the TCRAs and the time when the SGP project is constructed; therefore, it is necessary for the repository to be designed to standards that could constitute a permanent disposal location for the waste material while taking advantage of the existing heap leach pad liner systems. This is consistent with the requirement of the ASAOC Statement of Work (SOW) (EPA and USDA-FS, 2021), and is necessary to meet substantive regulatory requirements for waste containment, including protection of the surface water and groundwater in the repository area.

The primary goal of the TCRA is to reduce the uncontrolled release of metals and sediment to surface water through the removal of mine waste located within the floodplain of the EFSFSR. Specific RAOs for the project are:

- The primary objective of this TCRA is to eliminate or reduce potential ecological and human exposure to metals by mitigating sources of contamination from contact with sediment and surface water.
- Protect surface water and sediment quality in the EFSFSR by consolidating mine waste material, tailings, and impacted soil/sediment in an on-site repository that is a permanent disposal location for the waste materials and eliminates migration of hazardous constituents to the environment.

The general response actions to achieve the RAO are:

- Removal of 200,000 tons of waste material from the Bradley Man Camp Dumps located within the floodplain of the EFSFSR, removing mine wastes to underlying native materials
- Relocate materials to an on-site repository that is a physically stable disposal location for the waste materials. Design removal actions that provide long-term physical stability and have low maintenance requirements, that does not degrade the surface water and groundwater quality in the repository area and is protective of human health and the environment.

- Provide sufficient storage capacity to fully contain the 25,000 tons of lower Meadow Creek tailings and 200,000 tons of material excavated from the Bradley Man Camp Dumps.

Access to the Man Camp Dumps will require reopening an approximately 0.5-mile section of historical haul road. Excavation of the dumps would progress upstream to downstream for all material between the historical haul road and the EFSFSR. The dump material under the historical haul road would be excavated downstream to upstream as the equipment retreats from the dump area to accommodate erosion control and site reclamation.

The on-site repository will be designed to contain 25,000 tons of lower Meadow Creek tailings and 200,000 tons of material from the Bradley Man Camp Dumps. The consolidated tailings and mine waste will be graded to have a minimum slope of 3% to minimize ponding with a maximum slope of 33%. The repository will be covered with a minimum of 18 inches of clean fill material stabilized with temporary and permanent erosion control measures.

Four potential design alternatives were developed by Perpetua for the repository in the Revised Bradley Man Camp Dumps Removal and On-site Repository RCRA Work Plan (Perpetual, 2021):

- **Alternative C-1: Monofill Soil Cover**. Alternative C-1 would meet the repository cover requirements described in the ASAOC Statement of Work and would consist of 18 inches of clean fill material placed over the consolidated mine waste and tailings.
- **Alternative C-2: Evapotranspiration (ET) Cover**. Alternative C-2 would consist of a 54-inch cover system designed to limit the migration of meteoric water into the underlying tailings and mine waste by storing the water within the cover components until it is transpired through vegetation or evaporated from the soil surface. The ET cover would include 42 inches of fine general fill consisting of screened sand, silt, and clay-sized fill underlain by a 12-inch capillary break consisting of coarse sandy gravel.
- **Alternative C-3: Geosynthetic Cover**. Alternative C-3 would include either a high-density polyethylene/linear low-density polyethylene (HDPE/LLDPE) liner to limit the infiltration of meteoric water into the repository. The geosynthetic liner would be placed over 6 inches of prepared subgrade consisting of 2-inch minus waste rock. A drainage layer (coarse general fill or geocomposite) would be placed over the geosynthetic liner to direct infiltration off the liner. The drainage layer would be overlain by 18 inches of general fill. Alternatively, the cover system could be constructed with 24 inches of coarse general fill (e.g., sandy gravel) over the geosynthetic layer in lieu of the general fill and drainage layer.
- **Alternative C-4: Hybrid Cover**. Under this alternative the portion of the on-site repository that contains the lower Meadow Creek tailings would be encapsulated with a geosynthetic cover system (Alternative C-3) and the remainder of the repository would be covered with a monofill soil cover (consistent with Alternative C-1). Results of meteoric water mobility procedure (MWMP) geochemical testing indicate that the lower Meadow Creek tailings have a greater potential to release metals/metalloids (especially antimony) in comparison to materials in the Bradley Man Camp Dumps, and therefore, would benefit from a cover that includes a low permeability component.
- **Alternative C-5: Geosynthetic Cover with Water Treatment.** This alternative is identical to Alternative C-3, with a low-permeability geosynthetic cover over the entire facility but would also involve modification of the existing leachate management system to collect and store leachate and direct it to a water treatment plant constructed adjacent to the facility.

  The specific treatment technologies cannot be determined without a knowledge of the geochemical characteristics of the materials to be placed in the repository, the expected leachate chemistry from these materials, and the amount of leachate to be treated, which would be largely dependent on the effectiveness of the existing heap leach pad liner system. For the purposes of this alternatives analysis, leachate is assumed to be treated using E33 adsorption technology with a zero discharge backwash recycle system. Intermittent operation of the water treatment plant would require that electricity be available periodically, likely from an on-site diesel generator. Treated water would be discharged to the existing infiltration gallery currently receiving leachate from the existing on/off pads. This alternative would also entail long-term operational expenditures for sorption media replacement and off-site storage; electricity generation, and 30 years of groundwater monitoring.

The Agencies have evaluated the proposed alternatives and eliminated from consideration design alternative C-1 and C-2. The Agencies have narrowed the selection of design alternatives to C-3, C-4, and C-5. The Agencies will base their final selection of the design alternative on our evaluation of the data outlined below. During development of the detailed design, the repository configuration will be optimized, as appropriate, to include concepts identified in Alternative C-3 (a full geomembrane cover with no leachate collection and treatment), Alternative C-4 (a hybrid cover with no leachate collection and treatment) and/or Alternative C-5 (full geomembrane cover and leachate collection/treatment), based on additional information to be obtained by Perpetua (listed below), relevant existing data, and geochemical evaluation and calculation of expected leachate quality and quantity, and impacts to groundwater. The data and evaluation are intended to allow optimization of the extent of geomembrane cover required to minimize potential leachate generation and/or the need for leachate collection and treatment. The selected design alternative will result in a permanent repository for mine waste and will not cause or contribute to further contamination of the surface water or groundwater quality.

The repository uses an existing asphalt liner system, the integrity of which is unknown. Placement of a final cover with a geomembrane will reduce long-term percolation of precipitation into the waste material. Groundwater monitoring, data evaluation, and inspection of the final cover integrity will identify any issues with the waste containment system that may arise. Design, construction, operations (i.e., waste placement), and closure of the repository will meet the requirements of RCRA Subtitle D. If designed, constructed, operated, and monitored consistently with the relevant RCRA Subtitle D criteria, long-term operations and maintenance costs will likely be reduced because proven waste containment practices will result in effective long-term containment of the TCRA waste.

The repository investigation must obtain data to inform optimization of the repository design, include information on materials that will be consolidated within the future repository and subject to leaching until repository drain down is complete, as well as data on the groundwater and the subsurface between the bottom of the repository and groundwater, to evaluate expected leachate generation (quality and quantity) and impacts to groundwater. The repository investigation sampling objectives, data, and evaluation needs are listed below. As the investigation progresses, refinements will be made to this list.

- Data is needed on the **solid materials that will be within the repository** (existing spent ore, Lower Meadow Creek tailings, and Bradley Man Camp Dumps waste) and on solid samples obtained from the new monitoring well borings, to identify the total acid generating or neutralizing potential of the samples and concentrations of constituents in leachate derived from that material, including the following:
  - Multi-element analysis for metals analysis using four-acid digestion followed by ICP-MS or ICP-AES) to determine total chemistry for 48 elements plus mercury.
  - Acid base accounting (ABA) using the modified Sobek method with sulfur speciation by hot water, hydrochloric acid, and nitric acid extraction with Siderite Correction Method for determination of neutralizing potential.
  - Net Acid Generation (NAG) test
  - Nevada Meteoric Water Mobility Procedure and analysis of leachate.
- Data is needed on **the leachate currently discharging from the northwest corner of the former heap leach pads** (e.g., sample location YP-M-1 and other relevant sampling locations to characterize the existing leachate). The current leachate should be analyzed for metals (dissolved and total), total dissolved solids, alkalinity, anions (including fluoride, chloride, nitrite-N, bromide, orthophosphate-P, Sulfate, Nitrate), ammonia. Include field measurements of. pH, temperature, dissolved oxygen, oxidation reduction potential and conductivity.

- Data is needed on the **groundwater quality**, up- and down-gradient of the On/Off pads, including data from monitoring well network (new and existing) that will be established for the repository. Groundwater should be analyzed for metals (dissolved and total), total dissolved solids, alkalinity, anions (including fluoride, chloride, nitrite-N, bromide, orthophosphate-P, Sulfate, Nitrate), ammonia. Include field measurements of pH, temperature, dissolved oxygen, oxidation reduction potential, and conductivity.
- **Elevation data** is needed, including current groundwater elevations, historical high groundwater elevations, the elevation of the top of the spent ore, and estimated or measured elevation of the heap leach pad liner system.
- **Samples of soil from new well borings for characterization of multielement chemistry** (whole rock analysis per geochemical requirements listed above for the waste materials) for attenuation capacity and geotechnical information for estimation of permeability, porosity, bulk density, etc.
- **Supporting information for the initial, July 2021 Attenuation Study**, including data input, assumptions used in development of the study, and the study calculations.

Preliminary engineering designs have been prepared. Filling these data gaps to allow optimization, refinement, and finalization of these designs is a priority of Perpetua. A Field Sampling Plan and Quality Assurance Project Plan have been prepared to guide efforts to address these deficiencies. Data reports produced as an outcome of these field efforts will be used by project engineers to complete the designs and construction management plans.

Perpetua has developed a schedule to accomplish the foregoing activities as well as procedures to gain Agency approval for any changes that may occur as these projects progress. The current schedule includes provisions for all needed data to fill identified gaps to be collected during the summer and fall of 2021 with final design packages developed and approval received from EPA and the Forest Service during the winter of 2021/2022. Construction contracts would then be bid with earth-moving commencing once snow conditions allow during the field season of 2022.

2 INTRODUCTION

Respondents Perpetua Resources Corp., Perpetua Idaho, Inc. (formerly Midas Gold Corp. and Midas Gold Idaho, Inc. Respectively), Idaho Gold Resources Company, LLC and Stibnite Gold Company (collectively "Perpetua Respondents" or "Perpetua") prepared a Work Plan to guide the implementation of a Time Critical Removal Action (TCRA) at the Bradley Man Camp Dumps within the Stibnite Mining District (Site) in Valley County, Idaho (refer to Figure 2-1) and for construction of a repository to contain waste removed from the Bradley Man Camp Dumps and the Lower Meadow Creek Tailings (Perpetua, 2021). Perpetua's work plan included identification of design alternatives. This final TCRA Work Plan has been revised by the U.S. Environmental Protection Agency (EPA) and focuses on selecting a design alternative and data needed to finalize that selection. Perpetua Respondents are implementing the TCRA in accordance with the requirements of an Administrative Settlement Agreement and Order on Consent (ASAOC) for Removal Actions with EPA and U.S. Department of Agriculture Forest Service (USDA-FS or Forest Service) (EPA and USDA-FS, 2021). The work is being conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This TCRA includes excavation of approximately 200,000 tons of material from the Bradley Man Camp Dumps for placement in an on-site repository that will be located on the historic On/Off Leach Pads. Perpetua developed five potential design alternatives for the repository (Perpetua, 2021):

Alternative C-1: Monofill Soil Cover. Alternative C-1 would consist of 18 inches of clean fill material placed over the consolidated mine waste and tailings.

Alternative C-2: Evapotranspiration (ET) Cover. Alternative C-2 would consist of a 54-inch cover system designed to limit the migration of meteoric water into the underlying tailings and mine waste by storing the water within the cover components until it is transpired through vegetation or evaporated from the soil surface. The ET cover would include 42 inches of fine general fill consisting of screened sand, silt, and clay-sized fill underlain by a 12-inch capillary break consisting of coarse sandy gravel.

Alternative C-3: Geosynthetic Cover. Alternative C-3 would include either a high-density polyethylene (HDPE)/linear low-density polyethylene (LLDPE) liner or a geosynthetic clay liner (GCL) to limit the infiltration of meteoric water into the repository. The geosynthetic liner would be placed over 6 inches of prepared subgrade consisting of 2-inch minus waste rock. A drainage layer (coarse general fill or geocomposite) would be placed over the geosynthetic liner to direct infiltration off the liner. The drainage layer would be overlain by 18 inches of general fill. Alternatively, the cover system could be constructed with 24 inches of coarse general fill (e.g., sandy gravel) over the geosynthetic layer in lieu of the general fill and drainage layer.

Alternative C-4: Hybrid Cover. Under this alternative the portion of the on-site repository that contains the lower Meadow Creek tailings would be encapsulated with a geosynthetic cover system (Alternative C-3) and the remainder of the repository would be covered with a monofill soil cover (consistent with Alternative C-1). Results of meteoric water mobility procedure (MWMP) geochemical testing indicate that the lower Meadow Creek tailings have a greater potential to release metals/metalloids (especially antimony) in comparison to materials in the Bradley Man Camp Dumps, and therefore, would benefit from a cover that includes a low permeability component.

Alternative C-5: Geosynthetic Cover with Water Treatment. This alternative is identical to Alternative C-3 with a low-permeability geosynthetic cover over the entire facility but would also involve modification of the existing leachate management system to collect and store leachate and direct it to a water treatment plant constructed adjacent to the facility.

The specific treatment technologies cannot be determined without a knowledge of the geochemical characteristics of the materials to be placed in the repository, the expected leachate chemistry from these materials, and the amount of leachate to be treated, which would be largely dependent on the effectiveness of the existing heap leach pad liner system. The initial concept for treatment assumes that leachate is assumed to be treated using E33 adsorption technology with a zero discharge backwash recycle system. Intermittent operation of the water treatment plant would require that electricity be available periodically, likely from an on-site diesel generator. Treated water would be discharged to the existing infiltration gallery currently receiving leachate from the existing on/off pads. This alternative would also entail long-term operational expenditures for sorption media replacement and off-site storage; electricity generation, and 30 years of groundwater monitoring.

The Agencies have evaluated the proposed alternatives and eliminated from consideration design alternative C1 and C2. The Agencies have narrowed the selection of design alternatives to C3, C4, and C5. The Agencies will base their final selection of the design alternative on our evaluation of the data outlined below. During development of the detailed design, the repository configuration will be optimized, as appropriate, to include concepts identified in Alternative C3 (a full geomembrane cover with no leachate collection and treatment), Alternative C4 (a hybrid cover with no leachate collection and treatment) and/or Alternative C5 (full geomembrane cover and leachate collection/treatment), based on additional information to be obtained by Perpetua (listed below), relevant existing data, and geochemical evaluation and calculation of expected leachate quality and quantity, and impacts to groundwater. The data and evaluation are intended to allow optimization of the extent of geomembrane cover required to minimize potential leachate generation and/or the need for leachate collection and treatment. The selected design alternative will result in a permanent repository for mine waste and will not cause or contribute to further contamination of the surface water or groundwater quality.

A more detailed description of selected design alternative and the rational for selection is provided in Section 7. Sections 4 and 5 identify data gaps and analyses that must be addressed to support the design selection.

2.1 PURPOSE

The Bradley Man Camps dumps (also referred to as the Upper and Lower Man Camp dumps) are a large area of mine wastes and fill of various and poorly documented origins immediately adjacent to the East Fork of the South Fork Salmon River (EFSFSR) and are a source of metals and sediment to the river. In accordance with the requirements of the ASAOC, Perpetua will conduct a TCRA to remove approximately 200,000 tons of mine waste from the dumps located within the floodplain for placement in an on-site repository. The repository will be constructed on the existing On/Off Leach Pads (also known as the Canadian Superior Heap Leach Pads; Figure 2-1).

The repository falls within the project footprint of the Stibnite Gold Project (SGP), and materials therein would be moved to permanent development rock storage facilities in the SGP mine plan during construction or early operational periods by 2028, should the SGP be constructed. There is no certainty that Perpetua will receive the necessary approvals and authorizations to operate the mine. However, even if mining is approved and permitted, there will still be a period of time between implementation of the TCRAs and the time when the SGP project is constructed; therefore, it is necessary for the repository to be designed to standards that could constitute a permanent disposal location for the waste material while taking advantage of the existing heap leach pad liner systems. This is consistent with the requirement of the ASAOC Statement of Work (SOW) (EPA and USDA-FS, 2021), and is necessary to meet substantive regulatory requirements for waste containment, including protection of the surface water and groundwater in the repository area.

The purpose of this Work Plan is to identify the selected design alternative for the TCRA that best satisfies the design considerations and removal action objectives (RAOs). For the repository, additional information is needed to finalize the selection. Data gaps are identified that need to be addressed to optimize the repository design and finalize the alternative selection. Data needs are also identified for use in addressing these data gaps to support the engineering design process for the TCRA. Other supporting information is also included herein to provide for a full understanding of the basis from which the TCRA will proceed.

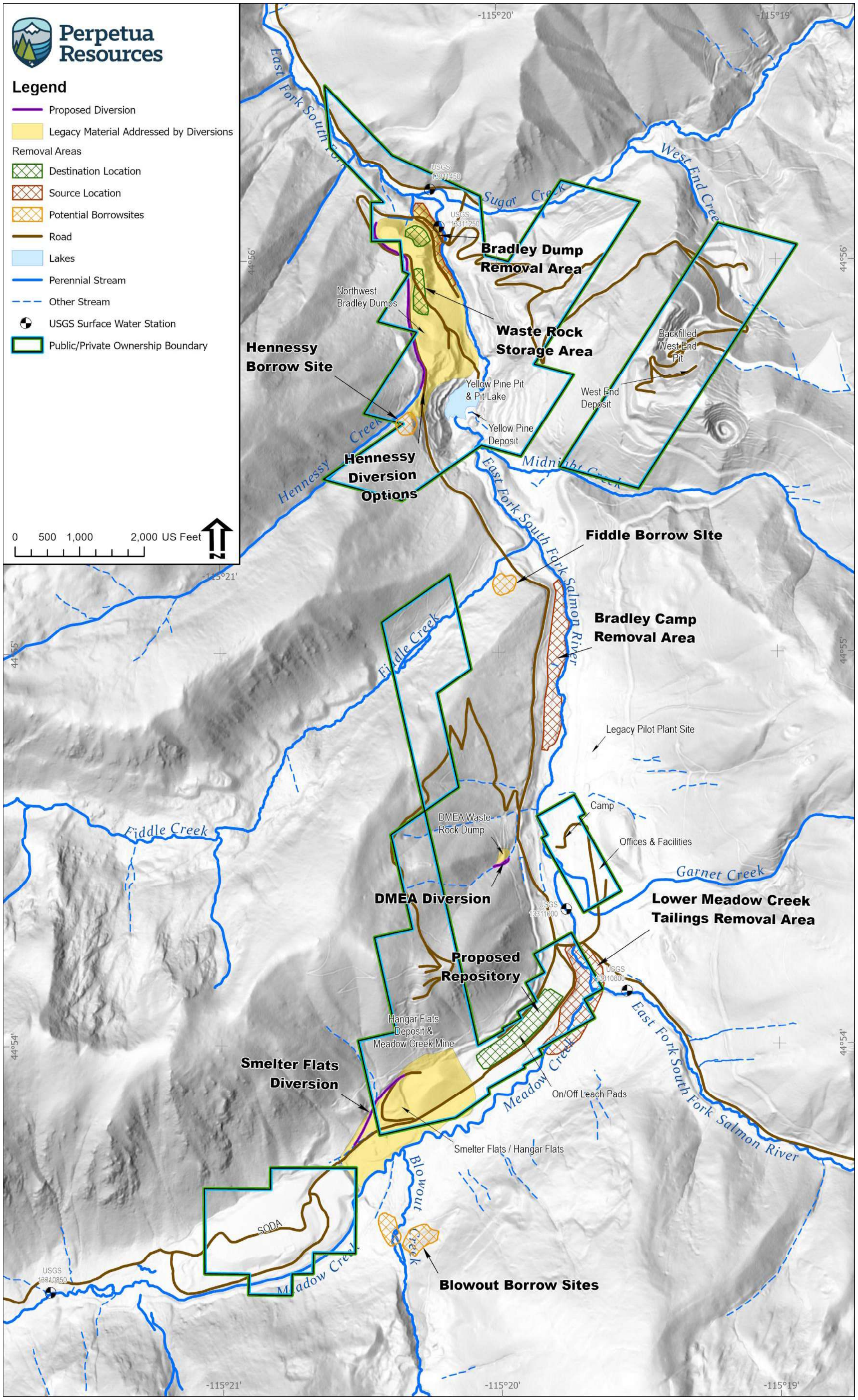

Figure 2-1 Site Location Map

2.2 DOCUMENT ORGANIZATION

The remainder of this Work Plan is organized as follows:

- **Section 3** provides Site background information.
- **Section 4** summarizes the available information regarding the sources, nature and extent of contamination, and identifies data needed to support the design of the removal action.
- **Section 5** describes the field sampling program and data needs that will support the design of the removal action.
- **Section 6** summarizes the applicable or relevant and appropriate requirements (ARARs) for potential removal actions at the Site.
- **Section 7** presents the selected design alternative and the rationale for selection.
- **Section 8** identifies the RAOs, design considerations, removal action technologies, and resource protection procedures for the TCRA.
- **Section 9** summarizes the anticipated schedule of the selected removal action.
- **Section 10** describes the procedures that will be followed for design changes and for obtaining agency (EPA and USDA-FS) approval of the changes.
- **Section 11** describes procedures for complying with EPA's Off-Site Rule.
- **Section 12** is a list of references.

Supporting information for the TCRA Work Plan are provided the appendices, including:

- **Appendix A**, Preliminary Engineering Design Documents.
- **Appendix B**, Environmental Protection Plan.
- **Appendix C**, Historical On/Off Leach Pad Design.

3 SITE BACKGROUND INFORMATION

The Stibnite Mining District is located in Valley County, approximately 50 miles east of McCall, Idaho (refer to Figure 2-1). The Site is located on a mixture of private property and public lands under the jurisdiction of the Forest Service under administrative management of Payette National Forest. Additional information regarding the site history, hydrology, and climate of the site and surrounding area is provided in the following subsections.

3.1 PHYSIOGRAPHY

The Project Area for the TCRA is located within the Salmon River Mountains of central Idaho. The area is comprised of steep, rugged, and forested mountains at an elevation of approximately 7,800 to 8,900 feet with narrow, flat valleys at an elevation of approximately 6,500 feet. The land is forested with coniferous trees and shrub understory. Large forest fires burned much of the area in 2002, 2006, and 2007. The Bradley Man Camp Dumps are located adjacent to the EFSFSR, approximately 1,000 feet upstream of the Fiddle Creek confluence along the west side of the river (Figure 2-1). The upstream dump measures approximately 700 feet by 250 feet and averages 8 feet thick (Figure 3-1). The downstream dump measures approximately 1,500 feet by 250 feet and averages 9 feet thick. The total volume of material is approximately 137,000 cubic yards (CY) (105,000 cubic meters; 200,000 tons) and rock grain size ranges from boulder to coarse sand based on recent site photos (Figure 3-2 and Figure 3-3). Vegetation on the dumps is limited to coniferous trees generally less than 20 feet in height although some larger trees exist along the dump toe. The dumps are surrounded by scrub-shrub wetlands and small areas of emergent wetlands. The On/Off Leach Pads are located in Lower Meadow Creek Valley (LMCV) near the confluence with the EFSFSR (Figure 2-1).

3.2 CLIMATE AND HYDROLOGY

The climate of the Stibnite Mining District is influenced by topography, slope aspect, and elevation (Brown and Caldwell, 2017) and is characterized by moderately cold winters and mild summers. Average annual precipitation at the Site is estimated to be approximately 32 inches (Table 3-1). Most precipitation occurs as snowfall in the winter and rain during the spring (Brown and Caldwell, 2017). The local climate has allowed for year-round mining operations as evidenced by historical production records.

The EFSFSR originates to the southeast of the Stibnite Mining District and is a tributary to the South Fork Salmon River approximately 25 miles west/northwest of the Site. The Bradley Man Camp Dumps are located in the floodplain of the EFSFSR, and the on-site repository will be constructed just upstream of the confluence of Meadow Creek and the EFSFSR (Figure 2-1). U.S. Geological Survey (USGS) streamflow gages are located on Meadow Creek upstream of the TCRA area and on the EFSFSR immediately upstream and downstream of the confluence with Meadow Creek. The gages were installed or re-established by the USGS for Perpetua in September 2011 to provide additional monitoring points within the Stibnite Mining District, three of which are relevant to this TCRA: 13311000 on the EFSFSR below Meadow Creek, 13310800 on the EFSFSR above Meadow Creek, and 13310850 on upper Meadow Creek (Brown and Caldwell, 2017). A summary of available data and flow statistics from the gages is provided in Table . A very consistent pattern of streamflow is observed at USGS gage 13311000 on the EFSFSR: low flow below 10 cubic feet per second (cfs) in late winter and early spring, with runoff flows greater than 100 cfs starting in April-May.

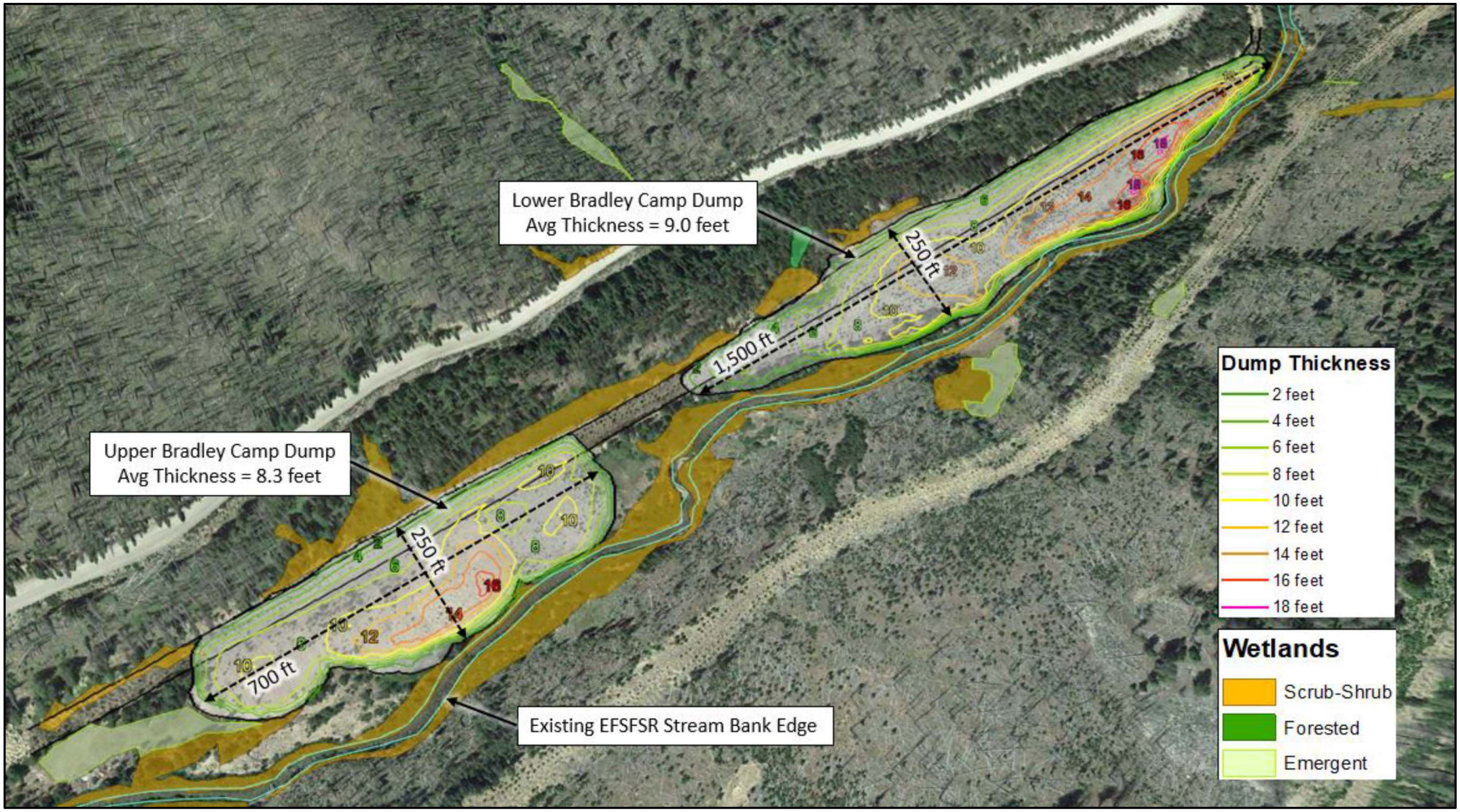

Figure 3-1 Bradley Man Camp Dumps

Figure 3-2 Lower Bradley Man Camp Dumps Site Photo

Figure 3-3 Upper Bradley Man Camp Dumps Site Photo

Table 3-1 Site Climate Data

Month	Average Temperature (°F)	Average Precipitation (inches)
January	20.1	4.1
February	21.8	3.3
March	27.7	3.5
April	32.9	3.0
May	40.7	2.6
June	48.7	2.1
July	58.1	1.0
August	56.5	1.0
September	48.7	1.8
October	39.2	2.1
November	26.3	3.7
December	18.8	4.0
Annual Total		**32.2**

Note: Monthly temperature and precipitation values estimated from Parameter-Elevation Regression on Independent Slopes Model (Tierra Group International, Ltd., 2013).

Table 3-2 USGS Gaging Stations: Drainage Area, Flow Statistics, and Period of Record

Gage Number	Location	Drainage Area (square miles)	Min. (cfs)	Max. (cfs)	Mean (cfs)	Median (cfs)	Period of Record (total years monitored)
13310850	Meadow Creek upstream of TCRA	5.6	1.37	129	11.68	3.58	09/2011 - present (8 years)
13310800	EFSFSR upstream of confluence with Meadow Creek	9	2.2	159	12.42	5.69	09/2011 - present (8 years)
13311000	EFSFSR downstream of confluence with Meadow Creek	19.3	3.8	365	26.90	11.00	1928 - 1943 1982 - 1997 2010 - present (40 years)

Notes:
cfs = Cubic feet per second
EFSFSR = East Fork of the South Fork of the Salmon River
TCRA = Time critical removal action
USGS = U.S. Geological Survey

References:
U.S. Geological Survey, 2021. National Water Information System, Idaho. https://waterdata.usgs.gov/id/nwis/ visited 3/3/21.

3.3 SITE LOCATION AND ACCESS

The property is located approximately 152 road miles northeast of Boise, Idaho. Access routes to the Project Area are illustrated on Figure 3-4 with the primary route known as the Johnson Creek Route. From Boise, the Johnson Creek route includes the following segments:

- Boise to Cascade – Highway 55 (77 miles).
- Cascade to Landmark – two-lane, paved Warm Lake Road (35.6 miles).
- Landmark to the town of Yellow Pine – single-lane, unpaved Johnson Creek Road (25.3 miles).
- Yellow Pine to Stibnite – single-lane, unpaved Stibnite Road (14 miles).

The Johnson Creek Route to the Site is approximately 74 miles from Cascade to Stibnite and is impassable during winter months due to excessive snow depths. Alternatively, the South Fork Route provides year-round access to Stibnite in part due to a lower elevation profile. The South Fork Route follows Warm Lake Road before turning north on the South Fork Road and then turning east onto the East Fork Road towards Yellow Pine and on to the Site via Stibnite Road (Figure 3-4). The distance from Cascade to Stibnite via the South Fork Route is approximately 96 miles.

Another route available in snow-free months starts by travelling east on Lick Creek Road near McCall towards Yellow Pine and onto Stibnite (known as the Lick Creek Route) (Figure 3-4). The distance from McCall to Stibnite via this access road is approximately 67 miles and from Cascade to Stibnite via McCall is approximately 94 miles. The distance from Boise to McCall via Highway 55 is 108 miles.

The Site is also accessible via air using a grass airstrip located along Johnson Creek Road approximately 3 miles south of the town of Yellow Pine or using a 2,300-foot-long improved gravel airstrip located at Stibnite (Figure 3-4). These airstrips are generally not used during the winter months due to the lack of snow removal equipment to maintain the facilities.

The former camp areas are entirely on public lands managed by the Krassel Ranger District, Payette National Forest. Access to the former camps is currently by foot from foot trails off the county road west of the site, or from the north and south along former haul roads.

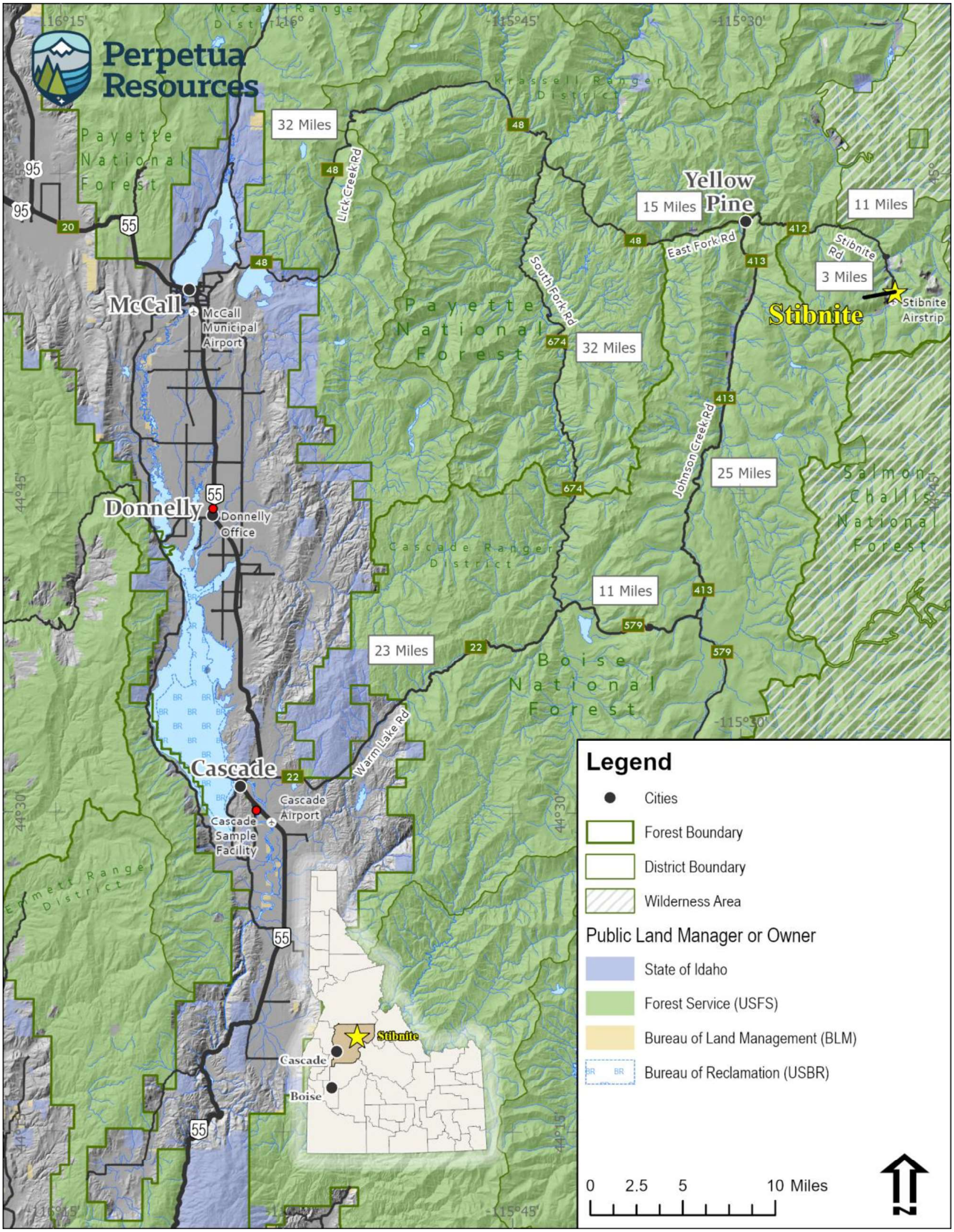

Figure 3-4 Site Location and Access

3.4 OVERVIEW OF MINING HISTORY

There have been two major periods of exploration, development, and operations in the Stibnite-Yellow Pine Mining District (District) prior to Perpetua's involvement with the property, one spanning from the early 1900s through the 1950s and another during the period from the early 1970s through the mid-1990s. Activities that occurred over the past century have left behind substantial environmental impacts that remain to this day. The history of development and mining in the District is summarized in numerous publications including: Schrader and Ross (1926), White (1940), Cooper (1951), Hart (1979), Mitchell (2000), and various unpublished reports and documents prepared by Perpetua and others. Much of the information presented herein was obtained from these sources and unpublished Perpetua records.

The mining history of the region began in 1894 when the Caswell brothers began a sluice box operation along Monumental Creek in what is now known as the Thunder Mountain Mining District, located east of Stibnite. By 1902, a gold rush was underway at that location along with associated development of roads and creation of the town of Roosevelt. By 1909, the gold rush was essentially over; that spring, a mudslide blocked Monument Creek creating present-day Roosevelt Lake and submerging the town of Roosevelt. During the Thunder Mountain gold rush, many prospectors passed through the area now known as the Stibnite-Yellow Pine District, discovering mercury, antimony, silver, and gold. However, no development of any significance was completed until around 1917, when the World War I demand for mercury led to the development of several properties east of the main Project Area, including the Hermes group of claims located by Pringle Smith in 1902 and the Fern group located by E. H. VanMeter in 1917 (Schrader and Ross, 1926).

The first period of large-scale development commenced in the mid-1920s and continued into the 1950s, involving mining of gold, silver, antimony, and tungsten by both underground and, later, open pit mining methods. During World War II, the District is estimated to have produced more than 90 percent (%) of the antimony and approximately 50% of the tungsten in the United States. Such materials were used in making munitions, steel, fire retardants, and for other purposes. Mining of these strategic minerals was considered so critical that the Federal government subsidized the mining activity, managed site operations, and allowed military time for soldiers to be served at the mine site. Strategic metal mining operations within the District continued through much of the Korean War with antimony, gold, and tungsten mining and milling ceasing in 1952, near the end of that conflict.

The second period of major activity in the District started with exploration activities in 1974 and was followed by open pit mining and seasonal on-off heap leaching and one-time heap leaching from 1982 to 1997. Ore during this period was provided by multiple operators from several locations and processed in adjacent heap leaching facilities.

Between these periods of development, numerous prospects were discovered and explored using data and information obtained from soil and rock sampling, trenching, drilling, geophysical methods, and geologic mapping. Several of these prospects were developed into successful mining operations.

3.5 OVERVIEW OF LEGAL HISTORY

The Stibnite Mining District has been the subject of significant cost recovery litigation under CERCLA, and several consent decrees emerged from these actions.

In Mobil Oil v. United States, Civ. No. 99-1467-A (D. Virginia) (consent decree filed June 26, 2000); the United States ultimately released Mobil Oil Co. (successor to Superior Mining, a former mining operator in the Stibnite Mining District) from future CERCLA response costs and provided $1.55 million to Mobil as partial reimbursement for their response costs. In the settlement, the United States and Mobil Oil exchanged covenants not to sue, though the United States reserved rights as to natural resource damages as well as a future cause of action for up to $1.1 million for the costs of constructing an impermeable cap for the Spent Ore Disposal Area (SODA). The impermeable cap for SODA called for in the Mobil Oil settlement was never constructed.

In United States of America and State of Idaho v. State of J. J. Oberbillig, Case No. CV 02-451-S-LMB (D. Idaho) (consent decree filed March 18, 2004), EPA and USDA-FS resolved outstanding CERCLA litigation related to the

Potentially Responsible Party interest in both the Stibnite and Cinnabar Sites. Removal actions at Stibnite called for in the Oberbillig settlement included rerouting a stream around a tailings ore pile and other activities pursuant to AOCs with Stibnite Mining Inc. and Mobil Oil. In settling the litigation, the Oberbillig Estate paid EPA $116,503 in reimbursed past response costs, the USDA-FS Service $35,703, and the State of Idaho $35,703.

In United States v. Bradley Mining Company, Case No. 3:08-CV-03968 TEH and United States v. Bradley Mining Company, Case No. 3:08-CV-05501 TEH (N.D. Ca.) (consent decree filed April 19, 2012) covered several additional sites in addition to the Stibnite Project. The consent decree concluded two separately filed cases that were consolidated in the United States District Court for the Northern District of California. In exchange for a payment by the United States to EPA for $7.2 million, CERCLA covenants not to sue were extended to the USDA-FS, United States Department of Defense, United States Department of the Interior, EPA, and United States General Services Administration. It is believed that no CERCLA response actions have taken place in the Stibnite Mining District since the Bradley Mining Company case was settled in 2012.

This ASAOC became effective January 15, 2021. The ASAOC expressly found that current water quality monitoring data indicates the presence of elevated levels of aluminum, arsenic, antimony, cyanide, iron, manganese, mercury, and thallium within the Stibnite Mining District. EPA and USDA-FS determined that current Site conditions constitute an actual or threatened release of a hazardous substance, and thus the Phase I TCRAs set forth in the ASAOC are necessary to protect the public health, welfare, or the environment.

The ASAOC declares in paragraph 7 that even though "Phase 1 Work is expected to provide lasting environmental benefits, even if full-scale mining and restoration never occur," the agreement will provide the option for "continued Work under this ASAOC during the [Perpetua] Respondents' execution of the [Plan of Restoration and Operations] (as ultimately reviewed and if approved), while avoiding disruption to the execution of PRO actions," see ASAOC paragraph 10. Accordingly, a longer-term response action strategy (through CERCLA non-time critical removal) is contemplated in subsequent Phases of the ASAOC if the Stibnite Gold Project becomes operational. "Returning a site of historic mining operations with legacy environmental issues to productive operations while addressing those legacy environmental issues has the potential to benefit the environment, economy, and local community." See ASAOC paragraph 10.

4 SOURCES AND NATURE AND EXTENT OF CONTAMINATION

The following subsections describe previous mining and disposal practices in the TCRA area, summarize monitoring results to define the extent of mining related impacts in the area, and identify data needed to support the design of the removal action.

4.1 PREVIOUS MINING ACTIONS AND DISPOSAL PRACTICES

4.1.1 Bradley Man Camp Dumps

Limited information is available regarding the history and construction of the Bradley Man Camp Dumps. The location has been utilized since at least the 1930s for various ancillary activities including a sawmill in 1930s, a laydown area in the 1940s, a camp for smelter workers in 1950s, and a camp and septic drain field in the 1980s-1990s. In the late 1990s or early 2000s, spent ore was placed (and/or regraded) and planted during reclamation work, but no detailed records describing this activity are available. The dumps are generally devoid of well-established vegetation.

A 1930s Army Map Service topographic map for the area indicates the EFSFSR meandered across the valley floor and at least part of the old channel was located on the west side of the current valley floor. By the late-1930s a haul road had been developed to transport ore from the Yellow Pine pit to the Meadow Creek Mill along the west side of the valley at the base of the slope below the current county road. This haul road and the surrounding area was subsequently filled in with materials of unknown origin, but presumably from the Yellow Pine Mine, which was the only active open pit mine during the 1940s. During this period, there were multiple buildings on the site adjacent to the haul road. Aerial photographs and field observations indicate the areas were filled in by 1946 with at least two and likely three lifts of fill materials, and field observations in a 2019 inspection of the site confirm the aerial photography interpretations. The last and highest lift on the southern camp area appears to be relatively recent and contains extensive angular, highly sulfidic boulders to gravel size stibnite-rich materials and a pronounced sulfur smell is present emanating from these dumps. Exploration ground geophysical surveys conducted in 2010 and 2011 indicate a large area exhibiting shallow highly conductive geophysical signatures consistent with the presence of sulfide-bearing fill materials observed at the surface.

At least two former large ponds and several smaller ponds (numbered 1 through 4 in the inset on Figure 4-1) are located along the west side of the EFSFSR as noted in aerial photography from 1945, 1946, and 1954; it is unknown what the ponds were utilized for. Remnants of former check dams are evident, and the former pond beds contain a variety of metallic debris, old drums, and trash.

Observations of cutbanks of meander bends in the EFSFSR between the two dumps indicates the presence of flood deposits, likely from the Blowout Creek event overlying and cutting through the former pond locations. Heavily iron-stained, fine-grained materials are interspersed with coarse gravels, cobbles, and boulders that are suggestive of the presence of former tailings—possibly mobilized during the Blowout Creek reservoir dam failure and subsequent flood.

4.1.2 Canadian Superior Heap Leach Pads

The Canadian Superior Mining Company (Superior) began exploration work in the Stibnite Mining District in 1974 (Millennium Science & Engineering, Inc. [MSE] 2011). They operated a pilot-scale cyanide heap leach plant on the east side of the EFSFSR near the southern portion of the Bradley Man Camp Dumps (Figure 2-1) in 1978 and 1980 to evaluate the feasibility of extracting gold from low-grade oxide ores and processed a series of 500-ton lots of material from the West End deposit in the plant.

Superior subsequently applied for permits from the Forest Service to operate a full-scale cyanide heap leach system (Mitchell 2000) and entered into a joint venture with Twin River Development to mine gold ore from an open pit (West End Pit) near the West End Creek drainage (Figure 2-1). Superior constructed a heap leach pad with five cells, lined ponds, a plant and refinery in the Meadow Creek Valley to process the ore (Figure 4-2). The leach pads were lined with 3 inches of asphaltic concrete, underlain by 12 inches of crushed base course, followed by a 30 mil polyvinyl chloride (PVC) secondary liner (James M. Montgomery Consulting Engineers, Inc. [JMM] 1981). A dilute sodium cyanide solution was applied to crushed ore on the pad to extract the gold. The pregnant solution was transferred to a lined pond near the processing plant for recovery in carbon columns. Residual cyanide in the depleted ore was neutralized by the addition of hypochlorite or a peroxide solution (URS Corp. [URS] 2000). An estimated 6,050,000 tons of neutralized ore were offloaded from the pads and placed on top of the Bradley tailings impoundment (Figure 4-3) in the upper Meadow Creek Valley between 1982 and 1994 in an area now referred to as the SODA.

Figure 4-1 1945 Aerial Photo of Upper Bradley Man Camp Dumps

4.1.2.1 Historical Geotechnical Investigations

In 1980, Northern Testing Laboratories issued a geotechnical report documenting an investigation concerning the subsurface conditions and engineering properties of the foundation of the On/Off Leach Pads (Northern Testing Laboratories, Inc. 1980). In July and August of 1980, five test pits, eight exploratory drill holes, and seven probe holes were performed in the leach pad area. These exploratory measures ranged in depth between 7 and 40 feet. The probe holes involved driving a 2-inch diameter solid point cone and were generally used to confirm depths to competent foundation material without any sample recovery. Other borings and test pits were performed by rotary drilling and a backhoe. Continuous logs of the soil properties were recorded, standard penetration and cone penetrometer resistance determined, samples obtained, and groundwater levels measured during the field exploration program.

Figure 4-2 1981 Aerial Photo of Canadian Superior Heap Leach Pads (center right)

The investigation results identified the following subsurface profile (from surface to increasing depth) at the On/Off Leach Pad area:

- Fill, Sandy Gravel **–** Dense to very dense crushed sandy gravel was found to depths ranging from 1 to 2.5 feet.
- Fill, Sand, Tailings **–** Generally loose to medium dense, poorly graded, fine sands were found below the sandy gravels along with some surface exposures located at the eastern edge of the site. These materials were moderately compressible.
- Topsoil **–** Original ground surface was encountered at depths of 1.5 to 5 feet. The compressible, organic topsoil varied from 0.5 to 3 feet thick. Greater thicknesses may be obscured by the fill.
- Sand/Gravel Mixtures **–** Medium dense to very dense, poorly sorted glacial-fluvial deposits below the original ground surface, including some loose to medium dense sand lenses. The materials had low compressibility and high strength.
- Silty Sand **–** Loose to medium dense 4.5-foot-thick zone of silty sand encountered at 10 feet at the southern section of the site. This material was only moderately compressible.

Figure 4-3 Spent Ore Being Placed on Bradley Tailings (circa 1982-1983)

The loose fill and topsoil were classified as unsuitable to support the On/Off Leach Pads due to high compressibility. However, the dense sand/gravel mixtures, generally found at depths from 1 to 6 feet, would likely provide adequate support with minor settlement.

Northern Testing Laboratories made the following recommendations regarding On/Off Leach Pad foundation construction:

- Remove all topsoil, organic material, and fill, including waste, from the proposed construction areas beneath the leach pads.
- All fill and backfill should be approved by a soils engineer, placed in uniform lifts, compacted to 95% of maximum dry density (ASTM D698), and 65% of relative density (ASTM D2049, clean and granular soils only).
- All foundations should receive support from the natural sand/gravel mixtures. In areas where support cannot be obtained at the desired elevation, the unsuitable material should be over-excavated and backfilled with approved granular fill and placed as previously described.

The liner design memo indicates that the foundation and liner system shall be capable of supporting construction equipment and ore loads of 10,000 pounds per square foot (psf) (Hovater-Way Engineers, Inc., 1981). Maximum anticipated additional load to the On/Off Leach Pads foundation will be 3,600 psf assuming a 25 foot maximum height of tailings and Bradley Man Camp Dump material at 120 pounds per cubic foot (pcf) dry density with assumed 20% moisture content. Existing ore maximum loading is 2,000 psf according to design documents (Northern Testing Laboratories, Inc., 1980). The On/Off Leach Pads foundation, constructed as described above, will provide adequate support for the proposed 5,600 psf combined loading anticipated from existing ore and the TCRA on-site repository.

4.1.2.2 Leach Pad Design Basis and Construction

As previously discussed, Superior constructed five leach pads in the Meadow Creek valley in the early 1980s. The historical design criteria and parameters originally used in the On/Off Leach Pads design are summarized in Appendix C. Because the on-site repository will be built over the previously constructed leach pads, it is important to be aware of the leach pads' design criteria and parameters and the potential impact on the on-site repository (refer to Section 7).

Each leach pad was approximately 213 feet long by 290 feet wide and contained by a 2-foot berm. The bottoms of the leach pads were sloped approximately 1% in a northeasterly direction toward the leach pads' collection boxes. The collection boxes were plumbed through a berm located on the northwestern side of the leach pads into a collection pipe that drained to the northeast. The liner system for each leach pad consists of the following components (top to bottom):

- 3 inches of asphaltic concrete with a sprayed seal coat.
- 12 inches of ¾-inch crushed base rock.
- A continuous PVC subliner over a polypropylene non-woven geotextile fabric.

The four interior berms, separating the five leach pads, were constructed using existing tailings reinforced with 45-mil Hypalon fabric, very likely over the existing continuous asphaltic concrete liner. Approximately 12 to 24 inches of leached material were typically left on the asphalt liner to protect the integrity of the liner system. During reclamation and pad closure, the berms and Hypalon fabric were removed, material excavated back to the base of the pad fill and backfilled with spent ore.

After signing of a State of Idaho Voluntary Consent Order as a result of a series of Notice of Violations (NOVs) from the facility and a 1995 Administrative Order on Consent with EPA in 1995, Stibnite Mine Inc. (SMI) modified their operating procedures. In addition, in 1995, SMI applied for a Cyanidation Permit from Idaho Department of Health and Welfare (IDHW), which is now Idaho Department of Environmental Quality (IDEQ). Up until this time, the Stibnite Mine, which initiated operations in 1982, did not require a permit for cyanidation because regulations at Idaho Administrative Procedures Act (IDAPA) 16.01.13010.01, permitted facilities existing prior to January 1, 1988, to operate as long as they registered with IDHW (IDEQ). The application was contested but eventually apparently granted since operations continued through 1997 and potentially included modifications to the heap leach pads and processing facilities. The changes outlined in the application included the following modifications from the existing designs, as quoted below from the application:

- Two 40-mil HPDE flexible membranes (FML) (double liner) to replace the existing liners at the four (4) solution ponds.
- The double liner systems to incorporate a leak collection and recovery system (LCRS) drainage net, between the HDPE flexible membrane liners, which drained to a collection sump.
- A monitoring and recovery pipe to be installed to each sump such that a water level probe could be placed inside the pipe for leak detection.
- The five existing leach pads, which consisted of a prepared subgrade, a 40-mil geotextile (to protect the FML), a PVC FML with overlying perforated drain collection pipes (LCRS), 12-14 inches of drain rock aggregate and three (3) inches of asphalt concrete, will be modified to include a new seal coat of a seamless thermo-plastic liner applied to the asphalt.
- Implementation of a quality assurance/quality control program for construction, routine inspections, installation and a revised surface and groundwater monitoring plan and modification to the land application infiltration gallery systems.

4.2 EXTENT OF CONTAMINATION

4.2.1 Distribution of Mine Wastes

An estimated 137,000 CY of mine waste is present in the Bradley Man Camp Dumps, based on sectional computer aided drafting (CAD) estimates, aerial photograph interpretation, and high resolution LiDAR topography, but the specific volume and depth of the dumps is uncertain. The basal surface of the dumps was estimated by projection of the surrounding topography on vertical sections. These features were used to develop triangular mesh solid models for the dumps. Significant incision has occurred in the EFSFSR associated with excavation of the Yellow Pine pit and increasing stream gradient and exacerbated from the Blowout Creek dam failure flood event. The stream reach through this section is generally well incised through existing floodplain deposits and although there is the possibility of some remnant tailings in the channel deposits themselves, if present they would likely be in small quantities and discontinuous. Floodplain deposits adjacent to the incised channel may contain remnant tailings where existing topography was low during the time of tailings deposition or during overbank flood events. Due to the incision, the stream channel is believed to be at lower elevation than the native ground surface and base of the man camp dumps.

Shallow soil samples were collected from Bradley Man Camp Dumps and described in the URS Site Characterization Report (Section 8.4.3.1 in URS, 2000) as having reddish yellow to medium brown coarse sand containing approximately 30% coarse fragments. Concentrations for the MAN-1 to MAN-3 samples are reported to range from 114-279 milligrams per kilogram (mg/kg) antimony, 156-1,240 mg/kg arsenic, 3.76-7.75 mg/kg lead, 0.28-0.46 mg/kg mercury, <0.28 mg/kg selenium, 0.52-1.38 mg/kg silver, and 3.5-10.8 mg/kg sulfate.

4.2.2 Water Quality

Water quality samples are collected from locations in the EFSFSR upstream, downstream, and adjacent to the Bradley Man Camp Dumps as part of Perpetua's ongoing water quality monitoring program. Sample location YP-SR-10 is approximately 2,500 feet upstream of the southern end of the dumps. Location YP-SR-8 adjacent to the dumps, approximately 800 feet south of northern end of the dumps, and YP-SR-6 is located approximately 2,500 feet downstream of the dumps, below the confluence with Fiddle Creek. Table and Table provide summary statistics for flow and water quality for pertinent sample sites from a 2018 Water Quality Summary Report (MGI, 2019). The historical domestic water supply well for the 1990s man camp is located on the dump, upstream of YP-SR-8, and was screened in alluvial materials below the dump from 19 to 39 feet. Water quality sampling results for this well reported in the URS report (URS, 2000) indicate antimony concentrations ranging from 112-138 micrograms per liter (µg/l), and arsenic ranging from 38.4 to 50.6 µg/L, which were deemed representative of natural background groundwater conditions for the EFSFSR area.

Table 4-1 Summary Statistics for EFSFSR Flow

Station	Name	Flow Statistics (cfs)			
		Min	Max	Median	Mean
YP-SR-10	EFSFSR Below Meadow Creek	6.2	169	15.4	38.9
YP-SR-8	EFSFSR Above Fiddle Creek	5.9	195	16.1	42.2
YP-SR-6	EFSFSR Above Yellow Pine Pit	8.0	216	18.1	49.3

Table 4-2 Summary of EFSFSR Water Quality Data

		Antimony (µg/L)				Arsenic (µg/L)				Mercury (µg/L)			
Station	WQ samples	Min	Max	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean	Median
YP-SR-10	90*	3.93	47.1	12.4	9.73	8.6	48.7	25.6	26.6	1	31.5	4.3	3.1
YP-SR-8	90*	5.7	61.8	17.0	12.55	12.3	57.7	29.2	29.4	0.5	20.1	4.2	3.2
YP-SR-6	90*	6.37	47.3	19.5	16.45	12.6	45.6	31.6	33.8	1.4	24.7	4.0	2.7

*Mercury analyses one fewer

The water quality sampling shows moderate increases in dissolved arsenic concentrations and significant increases in dissolved antimony concentrations through the reach with the dumps. Measured between monitoring locations, dissolved arsenic and antimony load increases not accounted for by tributary inflows are highest during periods of peak runoff, and lower during low-flow periods. This seasonality is consistent with flushing of mine wastes adjacent to the stream during snow melt coupled with additional background inflows during baseflow periods from either alluvial groundwater, hyporheic exchange between the stream and waste rock dumps, seepage of water from perched wetlands on top of the dumps adjacent to the hillside, or other sources in the vicinity such as materials in the former sawmill ponds. Diffuse inflows are also potentially attributed to other mine wastes upstream or downstream of the dumps, on the western side of the EFSFSR, or from natural background sources, such as the nearby Scout antimony-gold deposit.

One sample of leachate from the Canadian Superior Mining (CSM) leach pads was collected as part of the MSE Site Assessment in May 2010 (MSE, 2011). The sample location is located at the northwestern corner of the facility at the outflow from the standpipe installed during IDEQ pad closure. Dissolved concentrations at sample location YP-M-1 measured 48.6 µg/l antimony, 350 µg/l arsenic, and <0.2 µg/l mercury. The full analytical data set and image showing sample location is provided in the MSE report.

4.2.3 Mine Waste Geochemistry

SRK Consulting (U.S.) Inc. (SRK) conducted MWMP geochemical characterization testing for SGP permitting on project development rock, historical waste materials, and surface samples from mineralized areas that are pertinent to the removal action activities (SRK 2017).

Historical waste rock and surface sample testing are likely representative of materials to be removed from the basal lifts of the Bradley Man Camp Dumps, which were sourced from the Yellow Pine deposit area. Testing results for West End development rock and spent ore materials are likely representative materials on the upper lifts of the Bradley Man Camp Dumps. Tailings samples collected from the Bradley tailings pond are likely representative of tailings materials to be removed from the lower Meadow Creek and Schoolhouse tailings ponds.

SRK concluded that "the MWMP results indicate that freshly mined development rock associated with the SGP has a low potential to generate acid or leach metal and metalloids, with the exception of arsenic, antimony and aluminum. A higher potential for metals leaching/acid rock drainage (ML/ARD) was observed for four of the weathered ore grade samples of alaskite and quartz monzonite from the existing facilities within the Hangar Flats and Yellow Pine pit areas; however, Ficklin metal release is still generally less than 1 milligram per liter (mg/L) even under low pH conditions." Weathered surface samples of altered quartz monzonite (the primary ore host) collected from the Yellow Pine pit, have average MWMP release rates of 0.91 mg/L arsenic and 0.339 mg/L antimony.

The analysis for West End development rock samples concludes that "the West End samples show an overall lower potential for ML/ARD [as compared to the Hangar Flats and Yellow Pine deposits]. In general, the West End samples show a lower potential release of arsenic and antimony, which can be attributed to the lower sulfide sulfur concentrations observed for the West End lithologies."

MWMP results for SODA material likely representative of spent ore remaining on the On/Off Leach Pads, and possibly on the upper lifts of the Man Camp Dumps, have mean MWMP metal release of 2.2 mg/L arsenic and 0.85 mg/L antimony. SRK states "The sum of the Ficklin metals (i.e., cadmium, cobalt, copper, lead, nickel and zinc) was below 0.01 mg/L for all of the samples. These results reflect the limited amount of weathering products due to low initial sulfide (material classified prior to mining as "oxide") that are available for mobilization from the SODA material."

MWMP results for 13 composite Bradley tailings samples have average MWMP release rates of 0.44 mg/L arsenic and 31 mg/L antimony. The high antimony release in the tailings samples is consistent with elevated concentration of antimony and incomplete antimony recovery in historical mineral processing operations.

4.3 PREVIOUS REMOVAL AND CLEANUP ACTIONS

As previously discussed, an unknown volume of spent ore was placed over previous fill in the late 1990s or early 2000s and planted in an effort to reclaim the Bradley Man Camp Dumps. No removal or cleanup actions are associated with the Bradley Man Camp Dumps.

The On/Off Leach Pad processing facilities were partially closed and reclaimed by Thorton Construction as part of the IDEQ implementation of the reclamation plan after SMI went bankrupt in 1998. Work included the installation of a buried pipeline that was designed to collect all pad effluent from the leach pads and route this water to the Land Application Infiltration Gallery Area (LAIG). It is unknown if this is the site north of the facility or the area north of the airstrip. The pipe was planned to run just north of Pad A, under the haul road, and then attach to the LAIG intake. The total distance of buried pipe was reportedly approximately 450 feet. The pipe was designed to gravity feed water to the LAIG intake point. This pipeline reportedly included a weir for measuring flow and taking water samples, which may still be present. The process ponds were reclaimed by mixing cement with residual sludge and water in the bottom of the ponds. The liners were cut at the top and then folded in. Liners and slimes from the Pilot Plant ponds were originally planned to be placed here (IDEQ-IDL-USFS_Reclamation_Cost_Data, 2002: 12-PA-99-06, dated June 6, 1999) as well, but a Contract Modification #2 (IDEQ-IDL-USFS_Reclamation_Cost_Data, 2002: August 5, 1999) indicated that this may not have been performed. A 12-inch-thick cushion layer of clean fill dirt, no concrete or asphalt, was placed over the liners to prevent puncturing. About 1,700 CY of fill were hauled from an unknown source described as being a distance of approximately 2,600 feet away and were used to backfill the ponds. All asphalt and other demolition debris were backfilled into the ponds and buried north of the plant (personal communication, Bruce Schuld to Chris Dail, March 10, 2021). Soils adjacent to the ponds were then used to finish backfilling the ponds. The asphalt-lined solution ditch, northwest of the pads, was left intact and the piping to the LAIG was reportedly left in place.

4.4 DATA GAPS DISCUSSION

Data gaps pertinent to this TCRA include:

Information needed on the Bradley Man Camp Dumps waste, including:

- physical, geochemical, engineering, and chemical characteristics of the waste.
- Delineation of the extent of waste and characteristics of native material beneath the waste.
- Groundwater elevation data to inform excavation approach.

Information needed on the repository, including:

- Information on the location, configuration and condition of the current piping draining the heap leach pads and the existing land application infiltration gallery (LAIG).
- Elevation data including current groundwater elevations and historical high groundwater elevations, the elevation of the top of the spent ore, and estimated or measured elevation of the heap leach pad liner system.
- Analytical data for materials that will be consolidated within the future repository and subject to leaching until repository drain down is complete, including: the spent ore, Lower Meadow Creek Tailings, and Bradley Man Camp waste.
- Analytical data for leachate currently discharging from the northwest corner of the former heap leach pads (e.g., sample location YP-M-1 and other relevant sampling locations to characterize the existing leachate).
- Analytical data and elevations of groundwater up- and down-gradient of the On/Off pads, including data from monitoring well network (new and existing) that will be established for the repository.
- Supporting information for the initial, July 2021 Attenuation Study, including data input, assumptions used in development of the study, and the study calculations.

Details of sampling and investigation needs to address these data gaps are described in Section 5.

An additional significant data gap associated with the TCRA is the ability to procure suitable construction materials from an on-site borrow source. This latter data gap and associated field investigation is discussed under separate cover in the Field Sampling Plan.

The timing and sources of fill in the areas along the west side of the EFSFSR are unclear, but field observations indicate at least some altered and mineralized materials are present, which may represent former development rock, as well as materials that appear to be spent ore from the 1980s-90s operations. Because there are no high precision topographic maps available from pre-1930s operations when the area was occupied and used, the location of the base of these fill materials is known. Field observations suggest that native materials (glacial outwash and/or alluvial materials) may have been mixed or graded in with fill from elsewhere on the northern man camp site along the eastern side of the fill area.

There are no Perpetua groundwater monitoring wells in the vicinity of the man camps. Although the water table was identified in the initial well construction for the camp well located here in the 1980s, available subsequent monitoring data for the well do not report water elevations. Extensive earthwork and stream modifications have occurred since that well was installed and it is uncertain whether the data are reliable. Small low-lying areas, wetlands, and ditches as well as former stormwater management ponds along the west side of the fill adjacent to the base of the slope below the county road appear to remain saturated most of the year. At least some of these areas appear to be close to or at the top of the original ground surface based on the age of vegetation, topography, and historical aerial photography. This suggests the base of the fill may be the location of the current water table—at least locally.

Closure records for the heap leach facility are not well preserved and it is uncertain whether all components of the original reclamation plan and approved modifications were implemented at closure, which was completed by contractors for state and federal agencies after the operator's bankruptcy. In addition, the condition or even presence of some of the former heap drain and processing systems are unknown, as is the presence and location of remaining piping or modifications to that piping. It is also not known if any reclamation materials were placed on top of the remaining spent ore on the pads, or whether any stratification of materials exists within the pads and the exact thickness of these materials. Additional data gaps include the condition of the leach pad liner system (although use of the pads is already determined to be a component of the TCRA per the ASAOC).

5 FIELD SAMPLING, DATA, AND EVALUATION NEEDS

Proposed field work to support the Bradley Man Camp Dumps removal action include investigations in the removal and repository construction areas and borrow source investigations to identify materials for repository construction purposes. Details on how specific field investigations will be completed are presented in the Field Sampling Plan & Quality Assurance Project Plan (QAPP) (separate documents). A summary of field objectives is presented below.

5.1 BRADLEY MAN CAMP DUMPS FIELD INVESTIGATION GOALS AND OBJECTIVES

The primary objective of the field investigation of the Bradley Man Camp Dump waste is to determine the lateral and vertical extent of mine waste in the dumps and establish the performance standards on which to base the extent of excavation during the removal action. Additional study objectives are as follows:

- Determine physical and geochemical criteria, which indicate when native materials below the dumps have been encountered and establish performance standards for source material removal.
- Define the engineering characteristics and general composition of waste materials.
- Determine chemical characteristics of the waste material, described in additional detail in Section 5.2.
- Complete a field survey based on visual observations to delineate the lateral extent of the dumps for removal design.
- Investigate the potential presence and seasonality of groundwater within the dumps to support removal action planning and to avoid excavation of mine waste when saturated.

5.2 REPOSITORY Field Investigation GOALS AND OBJECTIVES

A principal objective of the repository investigation is to evaluate whether the On/Off Leach Pads can contain approximately 225,000 tons of waste material from the Man Camp Dumps and Lower Meadow Creek Tailings Removal. The information collected will inform the preparation of the detailed design, geotechnical stability modeling of the repository. Additional study objectives are as follows:

- Determine the current location/configuration of piping associated with the heap leach pads and where this water flows. For example, the field investigation should determine whether the northern piping system at the heap leach pad is intact, where that water flows, where the LAIG is located, etc.
- Determine the thickness and geotechnical characteristics of upper lifts of material placed on the heap leach pads during reclamation.
- Assess the condition of the intercell berm between cells 1 and 2 and establish whether the asphaltic liner is continuous beneath the berm.
- Establish survey control.

The repository investigation must also obtain data to inform optimization of the repository design, include information on materials that will be consolidated within the future repository and subject to leaching until repository drain down is complete, as well as data on the groundwater and the subsurface between the bottom of the repository and groundwater, to evaluate expected leachate generation (quality and quantity) and impacts to groundwater. The repository investigation sampling objectives, data, and evaluation needs are listed below. As the investigation progresses, refinements will be made to this list.

- Data is needed on the **solid materials that will be within the repository** (existing spent ore, Lower Meadow Creek tailings, and Bradley Man Camp Dumps waste) and on solid samples obtained from the new monitoring well borings, to identify the total acid generating or neutralizing potential of the samples and concentrations of constituents in leachate derived from that material, including the following:

- Multi-element analysis for metals analysis using four-acid digestion followed by ICP-MS or ICP-AES) to determine total chemistry for 48 elements plus mercury.
- Acid base accounting (ABA) using the modified Sobek method with sulfur speciation by hot water, hydrochloric acid, and nitric acid extraction with Siderite Correction Method for determination of neutralizing potential.
- Net Acid Generation (NAG) test
- Nevada Meteoric Water Mobility Procedure and analysis of leachate.

- Data is needed on **the leachate currently discharging from the northwest corner of the former heap leach pads** (e.g., sample location YP-M-1 and other relevant sampling locations to characterize the existing leachate). The current leachate should be analyzed for metals (dissolved and total), total dissolved solids, alkalinity, anions (including fluoride, chloride, nitrite-N, bromide, orthophosphate-P, Sulfate, Nitrate), ammonia. Include field measurements of. pH, temperature, dissolved oxygen, oxidation reduction potential and conductivity.
- Data is needed on the **groundwater quality**, up- and down-gradient of the On/Off Leach Pads, including data from monitoring well network (new and existing) that will be established for the repository. Groundwater should be analyzed for metals (dissolved and total), total dissolved solids, alkalinity, anions (including fluoride, chloride, nitrite-N, bromide, orthophosphate-P, Sulfate, Nitrate), ammonia. Include field measurements of pH, temperature, dissolved oxygen, oxidation reduction potential, and conductivity.
- **Elevation data** is needed, including current groundwater elevations, historical high groundwater elevations, the elevation of the top of the spent ore, and estimated or measured elevation of the heap leach pad liner system.
- **Samples of soil from new well borings for characterization of multielement chemistry** (whole rock analysis per geochemical requirements listed above for the waste materials) for attenuation capacity and geotechnical information for estimation of permeability, porosity, bulk density, etc.
- **Supporting information for the initial, July 2021 Attenuation Study**, including data input, assumptions used in development of the study, and the study calculations.

6 ARARS IDENTIFICATION AND DISCUSSION

ARARs for the TCRA are defined in the Action Memorandum (EPA and USDA-FS 2021). Additional guidance and regulatory requirements will be identified in the design packages.

7 SELECTED DESIGN ALTERNATIVE

As specified in the ASAOC, Perpetua will excavate approximately 200,000 tons of material from the Bradley Man Camp Dumps for placement in an on-site repository located on the historic On/Off Leach Pads.

For the repository, the Agencies have evaluated the proposed alternatives developed by Perpetua (Perpetua, 2021) and eliminated from consideration design Alternative C-1 and C-2. The Agencies have narrowed the selection of design Alternatives to C-3, C-4, and C-5. Data gaps that need to be addressed for further consideration of an optimized repository cover and/or leachate collection and treatment design (i.e., design elements of Alternatives C-3, C-4, or C-5) are identified in Section 4 and data collection goals and objectives are outlined in Section 5. The Agencies will base their final selection of the repository design alternative on evaluation of the new data outlined in Section 5, relevant, existing data, and geochemical evaluation and calculation of expected leachate quality and quantity, and impacts to groundwater.

During development of the detailed design, the repository configuration will be optimized, as appropriate, to include concepts identified in Alternative C-3 (a full geomembrane cover over the entire repository, with no leachate collection and treatment), Alternative C-4 (a hybrid cover where the geomembrane is only placed over part of the repository, with no leachate collection and treatment) and/or Alternative C-5 (full geomembrane cover and leachate collection/treatment). The data and evaluation are intended to allow optimization of the extent of geomembrane cover required to minimize potential leachate generation and/or the need for leachate collection and treatment. The selected design alternative must result in a permanent repository for mine waste that will not cause or contribute to further contamination of the surface water or groundwater quality.

The repository will utilize the existing bottom liner system present within the On/Off Leach Pads. After consolidation of 200,000 tons of waste from the Bradley Man Camp Dumps and 25,000 tons of waste from Lower Meadow Creek, an impermeable cover will be constructed. A HDPE/LLDPE liner will be used in the cover system (either partially covering the repository or covering the entire repository) to limit the infiltration of meteoric water into the repository. A GCL will not be included in the cover system because they are subject to degradation from freeze-thaw action. The cover system with the geomembrane would include the following components, from top to bottom:

- 18 inches of general fill containing cobbles, sand, gravel, silt, clay, etc. inoculated with topsoil and revegetated (e.g., using broadcast seeding with native seed mix).
- A drainage layer likely consisting of 6 inches of coarse general fill (consisting of a sandy gravel), or a geonet covered by a geotextile, or similar.
- A geosynthetic layer (HDPE/LLDPE liner).
- 6-inches of prepared subgrade consisting of 2-inch minus waste rock. Alternatively, the cover system could be constructed with 24 inches of coarse general fill (e.g., sandy gravel) over the geosynthetic layer in lieu of the general fill and drainage layer.

Modification of the existing leachate management system will be completed to collect, store, and treat leachate from percolation of any meteoric water through the cover system or draindown from wet materials placed in the facility, unless it can be demonstrated that this is not necessary based on additional investigations and analysis of potential leachate generation during development of the design. The specific modifications to the existing piping system cannot be determined prior to the findings of the field investigation but would likely entail use of the existing piping and liner to collect leachate and direct it via gravity to a water treatment plant constructed adjacent to the facility.

If a leachate treatment system is determined to be needed, the specific treatment technologies cannot be determined without a knowledge of the geochemical characteristics of the materials to be placed in the repository, the expected leachate chemistry from these materials, and the amount of leachate to be treated, which would be largely dependent on the effectiveness of the existing heap leach pad liner system. Uncertainties aside, for planning and cost estimating purposes, leachate is assumed to be treated using E33 adsorption technology with a zero discharge backwash recycle system, such as those available from AdEdge H2Zero (H2Zero Recycle Backwash.pdf). This system would entail treatment vessels, a backwash holding tank, a reclaim pump skid with control module, particle filtration system, and a treated water storage tank. Intermittent operation of the water treatment plant would require that electricity be available periodically, likely from an on-site diesel generator. Treated water would be discharged to the existing infiltration gallery currently receiving leachate from the existing on/off pads. The selected alternative would also entail long-term operational expenditures for sorption media replacement and off-site storage, electricity generation and attendant staffing, equipment, and fuel haulage

Alternatives C-3, C-4, and/or C-5 will all include 30 years of groundwater monitoring, as indicated to be necessary through agency-stipulated ARARs.

The design evaluation and the repository design will be reviewed and approved by the Agencies once information on these data gaps is available.

- Information on the location, configuration and condition of the current piping draining the heap leach pads and the existing LAIG.
- Elevation data including current groundwater elevations and historical high groundwater elevations, the elevation of the top of the spent ore, and estimated or measured elevation of the heap leach pad liner system.
- Analytical data for materials that will be consolidated within the future repository and subject to leaching until repository drain down is complete, including: the spent ore, Lower Meadow Creek Tailings, and Bradley Man Camp waste. This includes metals and cyanide concentrations, MWMP leach testing and analysis for metals.
- Metals and cyanide concentrations in the leachate currently discharging from the Northwest corner of the former heap leach pads (e.g., sample location YP-M-1 and other relevant sampling locations to characterize the existing leachate).
- Groundwater quality data, up- and down-gradient of the On/Off Leach Pads, including data from monitoring well network (new and existing) that will be established for the repository.
- Supporting information for the initial, July 2021 Attenuation Study, including data input, assumptions used in development of the study, and the study calculations.
- Incorporation of the new data into a revised evaluation of the repository leachate quantity and chemical composition.

The final repository design alternative will also be selected based on evaluation of effectiveness and implementability as described below. TCRA removal action design alternatives are evaluated against short- and long-term aspects of effectiveness and implementability (EPA, 1991). A general description of each criterion is provided below. Costs are presented below but were not a selection criterion for the TCRA design alternative.

7.1 EFFECTIVENESS

A key aspect in selecting a removal alternative is evaluation of the effectiveness of each alternative in protecting human health and the environment. Effectiveness of an alternative is evaluated against the following criteria:

- Overall protection of human health and the environment.
- Compliance with ARARs.
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume through treatment.

- Short-term effectiveness.

The optimized repository (Alternative C-3, C-4 or C-5) will be highly effective because, with proper maintenance, it will provide permanent waste containment that is protective of surface water and groundwater quality. Use of an impermeable geomembrane in the cover, collection and treatment of leachate, long-term groundwater monitoring, and maintenance of the cover will prevent further contamination of the groundwater and surface water from the repository. Long-term effectiveness will be achieved through construction of a cover that is erosion resistant, by conducting inspections of the repository and maintenance if needed, and by monitoring the groundwater for impacts from the repository. Design, construction, operations (waste placement and leachate collection/treatment), closure, and monitoring will be conducted in accordance with ARARs, including incorporation of Resource Conservation and Recovery Act (RCRA) Subtitle D criteria and procedures. Leachate collection and treatment until draindown is complete will prevent impact to surface water and groundwater unless/until it is demonstrated that this is not necessary.

In addition, the optimized repository will be highly effective because they use standard practices for waste containment in the short term (i.e., between TCRA implementation and initiation of mining activity at this location, if it occurs), during interim periods when the repository is closed but still generating leachate, and in the long-term when leachate is no longer being generated.

The repository uses an existing asphalt liner system. Although the integrity of the existing asphalt liner system is unknown, placement of a final cover with a geomembrane (whether full or partial) will be designed to reduce long-term percolation of precipitation into the contaminated waste material. If designed, constructed, operated, and monitored consistently with the relevant RCRA Subtitle D criteria and procedures, long-term operations and maintenance costs will be reduced because proven waste containment practices will result in sound, long-term containment of the TCRA waste.

7.2 IMPLEMENTABILITY

Implementability addresses the technical and administrative feasibility of implementing an alternative, as well as the availability of the services, personnel, and materials necessary to implement it. Technical feasibility considerations include the applicability of the alternative to the contaminant source and overall reliability of the alternative. Implementability includes:

- Construction and operational considerations, including schedule and the availability of personnel, equipment, and materials.
- Infrastructure requirements (e.g., power).
- Reliability and simplicity/complexity of operation and any required maintenance.
- Remoteness of location, accessibility, and climatic conditions.

Evaluation of the administrative feasibility of implementing the alternative considers coordination or consultation with federal and state regulatory agencies, the need for permits or approvals, the availability of treatment, storage capacity, and disposal services, and the availability of the necessary technologies, equipment, and specialists.

The Alternatives C-3, C-4 and/or C-5 are highly implementable. Design and construction of a geomembrane cover system follows standard industry practices, and quality assurance/quality control procedures. Materials and labor are readily available. The design should be stamped by a registered Idaho Professional Engineer to verify that design aspects such as slope stability, friction angles, and process piping and instrumentation, are designed appropriately. There is some uncertainty in availability of borrow materials for soil components of the cover system, but multiple potential sources are being investigated on site. While there is uncertainty regarding the final chemistry of the leachate that may be produced, established industry practices may be followed for metals treatment, using skid-mounted treatment systems with the option for evaluating passive treatment approaches.

7.3 ESTIMATED COST

The cost estimates include future costs for each alternative over a life of 30 years using present worth analysis. The net present value (NPV) calculations include an annual discount rate (assumed to be 1.7% for this Work Plan; U.S. Office of Management and Budget [OMB] 2020) that addresses the time value of money. The discount rate is typically described as the interest rate that could be realized from a prudent investment. An escalation rate of 0.1% (U.S. Bureau of Labor Statistics, 2021) was used to estimate the annual increase in future costs due to inflation. Cost estimates were prepared in accordance with EPA guidance on preparing cost estimates for response actions under CERCLA (U.S. Army Corps of Engineers [USACE] and EPA, 2000) modified as appropriate to account for site-specific conditions. Unit costs were developed based on the USDA Cost Estimating Guide for Road Construction (USDA-FS, 2020), vendor quotes, and estimates from engineering design firms. The total cost for the selected design alternative is the cost of the Bradley Man Camp Removal (Table 7-1) plus the cost of the repository (Table 7-2, 7-3, 7-4).

7.3.1 Bradley Man Camp Dumps Removal Cost

The estimated cost to transfer approximately 200,000 tons (137,000 CY) of material from the Bradley Camp Dumps to the repository is $2.4 million (Table 7-1). This will require approximately 12 weeks to complete based on a 7 day per week, day shift only work schedule. Contingencies considered EPA guidance (USACE and EPA, 2000), modified as appropriate to account for site-specific conditions.

Table 7-1 Bradley Man Camp Dumps Removal Cost Estimate

Cost Item / Footnote	Description	Quantity	Units	Duration (days)	Unit Cost	Cost ($)
1	Salvage organic materials, establish erosion controls, and develop access	3,700	ft	2	$8.85	$32,739
2	Rebuild haul road	4,750	ft	8	$7.70	$36,575
3	Excavate legacy dump material	136,845	yd^3	66	$7.41	$1,013,465
4	Load, haul, place reclamation cover material	7,961	yd^2	4	$6.23	$49,569
5	Revegetate native ground below excavated dump	11.5	acre	6	$4,348	$50,171
					Equipment, Labor, & Supplies	**$1,182,520**

Mobilization / Demobilization (8.0%)	$90,602
Remote Site Room & Board	$185,000
Engineering (10.0%)	$118,252
Overhead (15.0%)	$177,378
Construction Monitoring (5.0%)	$59,126
Annual Post Construction Maintenance (2.5%)	$29,563
Annual Maintenance NPV (5 years)	$140,983
Subtotal	**$1,957,861**
Contingency (25.0%)	$489,465
Total Estimated Cost	**$2,447,326**

Footnotes

Note: All equipment listed below includes operator cost.

1 - Cost based on using a 350-HP dozer, a 48-HP skid steer, a 5-yd^3 loader (50%), a 40-ton truck (50%), two laborers, a survey crew (50%), and erosion controls.

2 - Cost based on using a 350-HP dozer with ripper attachment, a 4,000-gal water truck (50%), a 14-ft blade grader (50%), two laborers, and partial survey crew (25%).

3 - Cost based on using a 4-yd^3 excavator (80% productivity), four 40-ton trucks, 2.35-mile round-trip haul, a 350-HP dozer with ripper attachment to support loading, a 215-HP dozer to support material placement in repository, 235-HP sheep's foot compactor, a 4,000-gal water truck, and a survey crew (25%).

4 - Cost based on using a 4-yd^3 excavator, four 40-ton trucks, 3.5-mile round-trip haul, a 350-HP dozer, 4,000-gal water truck, and two laborers.

5 - Cost based on using a 115-HP mulcher, a 48-HP skid steer, two laborers, upland seed mix, fertilizer, and 321 plants per acre.

7.3.2 Alternative C-3, C-4, and C-5, Repository Cost Estimates

The estimated repository costs for Alternatives C-3, C-4, or C-5 are shown in the following tables.

Table 7-2 Alternative C-3 Repository Cost Estimate

Cost Item / Footnote	Description	Quantity	Units	Duration (days)	Unit Cost	Cost ($)
1	Screen, load, haul, & place material needed prior to placing geosynthetics	7,708	yd^3	4	$9.80	$75,499
2	Install geosynthetics	48,560	yd^2	10	$12.91	$626,982
3	Load, haul, & place general fill sourced from borrow	15,415	yd^3	9	$6.73	$103,729
4	Load, haul, dump, & spread cover material	7,708	yd^3	4	$6.73	$51,865
5	Revegetate repository cover with upland seed mix and plants	9.6	acre	5	$4,600	$43,949
					Equipment, Labor, & Supplies	**$902,023**

Mobilization / Demobilization (8.0%)	$72,162
Remote Site Room & Board	$64,250
Engineering (10.0%)	$90,202
Overhead (15.0%)	$135,304
Construction Monitoring (5.0%)	$45,101
Annual Post Construction Maintenance (2.5%)	$22,551
Annual Maintenance NPV (5 years)	$107,542
Subtotal	**$1,416,584**
Contingency (25.0%)	$354,146
Total Estimated Cost	**$1,770,730**

Footnotes

Note: All equipment listed below includes operator cost.

1 - Cost based on using a 9-yd^3 loader, two 40-ton trucks, 1.6-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), two laborers, and a 110-HP screen plant assuming 40% reject supported with a 5-yd3 loader and 350-HP dozer with ripper attachment.

2 - Cost based on using a 99-HP backhoe, a 48-HP skid steer, four laborers, 60-mil DST geotextile, 200-mil geonet, and 16-oz geotextile.

3 - Cost based on using a 9-yd3 loader, three 40-ton trucks, 3.1-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), and two laborers

.4 - Cost based on using a 9-yd3 loader, three 40-ton trucks, 3.1-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), and two laborers.

5 - Cost based on using a 115-HP mulcher, 48-HP skid steer, three laborers, upland seed mix, fertilizer, and 321 plants per acre.

Table 7-3 Alternative C-4 Repository Cost Estimate

Cost Item / Footnote	Description	Quantity	Units	Duration (days)	Unit Cost	Cost ($)
1	Screen, load, haul, & place material needed prior to placing geosynthetics	1,927	yd^3	1	$9.80	$18,875
2	Install geosynthetics	12,140	yd^2	3	$12.91	$156,750
3	Load, haul, & place general fill sourced from borrow	15,415	yd^3	9	$6.73	$103,729
4	Load, haul, dump, & spread cover material	7,708	yd^3	4	$6.73	$51,865
5	Revegetate repository cover with upland seed mix and plants	9.6	acre	5	$4,600	$43,949
					Equipment, Labor, & Supplies	**$375,169**

Mobilization / Demobilization (8.0%)	$30,013
Remote Site Room & Board	$43,750
Engineering (10.0%)	$37,517
Overhead (15.0%)	$56,275
Construction Monitoring (5.0%)	$18,758
Annual Post Construction Maintenance (2.5%)	$9,379
Annual Maintenance NPV (5 years)	$44,729
Subtotal	**$606,211**
Contingency (25.0%)	$151,553
Total Estimated Cost	**$757,764**

Footnotes

Note: All equipment listed below includes operator cost.

1 - Cost based on using a 9-yd^3 loader, two 40-ton trucks, 1.6-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), two laborers, and a 110-HP screen plant assuming 40% reject supported with a 5-yd3 loader and 350-HP dozer with ripper attachment.

2 - Cost based on using a 99-HP backhoe, a 48-HP skid steer, four laborers, 60-mil DST geotextile, 200-mil geonet, and 16-oz geotextile.

3 - Cost based on using a 9-yd3 loader, three 40-ton trucks, 3.1-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), and two laborers

.4 - Cost based on using a 9-yd3 loader, three 40-ton trucks, 3.1-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), and two laborers.

5 - Cost based on using a 115-HP mulcher, 48-HP skid steer, three laborers, upland seed mix, fertilizer, and 321 plants per acre.

Table 7-4 Alternative C-5 Repository Cost Estimate

Cost Item / Footnote	Description	Quantity	Units	Duration (days)	Unit Cost	Cost ($)
1	Screen, load, haul, & place material needed prior to placing geosynthetics	7,708	yd^3	4	$9.80	$75,499
2	Install geosynthetics	48,560	yd^2	10	$12.91	$626,982
3	Load, haul, & place general fill sourced from borrow	15,415	yd^3	9	$6.73	$103,729
4	Load, haul, dump, & spread cover material	7,708	yd^3	4	$6.73	$51,865
5	Revegetate repository cover with upland seed mix and plants	9.6	acre	5	$4,600	$43,949
6	Install and operate leachate treatment system	1	ea	5	$256,336	$256,336
7	Groundwater monitoring program (30 years)	5	ea	n/a	$94,737	$473,693
					Equipment, Labor, & Supplies	**$1,632,042**

Mobilization / Demobilization (8.0%)	$130,563
Remote Site Room & Board	$70,000
Engineering (10.0%)	$163,204
Overhead (15.0%)	$244,806
Construction Monitoring (5.0%)	$81,602
Annual Post Construction Maintenance (2.5%)	$40,801
Annual Maintenance NPV (10 years)[A]	$781,265
Subtotal	**$3,103,483**
Contingency (25.0%)	$775,871
Total Estimated Cost	**$3,879,354**

Footnotes

Note: All equipment listed below includes operator cost.

1 - Cost based on using a 9-yd^3 loader, two 40-ton trucks, 1.6-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), two laborers, and a 110-HP screen plant assuming 40% reject supported with a 5-yd3 loader and 350-HP dozer with ripper attachment.

2 - Cost based on using a 99-HP backhoe, a 48-HP skid steer, four laborers, 60-mil DST geotextile, 200-mil geonet, and 16-oz geotextile.

3 - Cost based on using a 9-yd3 loader, three 40-ton trucks, 3.1-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), and two laborers

.4 - Cost based on using a 9-yd3 loader, three 40-ton trucks, 3.1-mile round-trip haul, a 215-HP dozer, a 99-HP backhoe, a 14-ft blade grader (50%), a 4,000-gal water truck (50%), and two laborers.

5 - Cost based on using a 115-HP mulcher, 48-HP skid steer, three laborers, upland seed mix, fertilizer, and 321 plants per acre.

6 - Cost based on using a 99-HP backhoe, three laborers, a partial survey crew (50%), water treatment plumbing, a 2-phase genset, and a backwash system operated for 10 years.

7 - Cost based on five groundwater wells sampled quarterly for thirty years.

A – Annual maintenance includes 10 years of operating the leachate treatment system with an estimated annual operating cost of $44,357.

8 DESIGN CONSIDERATIONS

As described in the following subsections, this removal action was developed to satisfy the requirements of the ASAOC, satisfy the RAOs, and incorporate practical considerations of its implementation.

8.1 REMOVAL ACTION OBJECTIVES

The primary goal of the TCRA is to reduce the uncontrolled release of metals and sediment to surface water through the removal of mine waste located within the floodplain of the EFSFSR. Specific RAOs for the project are:

- Eliminate or reduce potential ecological and human exposure to metals by mitigating sources of contamination from contact with sediment and surface water.
- Protect surface water and sediment quality in the EFSFSR by consolidating mine waste material, tailings, and impacted soil/sediment in an on-site repository that is a permanent disposal location for the waste materials and eliminates migration of hazardous constituents to the environment.

The general response actions to achieve the RAO are:

- Removal of 200,000 tons of waste material from the Bradley Man Camp Dumps located within the floodplain of the EFSFSR, removing mine wastes to underlying native materials
- Relocate materials to an on-site repository that is a physically stable disposal location for the waste materials. Design removal actions that provide long-term physical stability and have low maintenance requirements, that does not degrade the surface water and groundwater quality in the repository area and is protective of human health and the environment.
- Provide sufficient storage capacity to fully contain the 25,000 tons of lower Meadow Creek tailings and 200,000 tons of material excavated from the Bradley Man Camp Dumps.

8.2 BASIS FOR DESIGN

This section provides design basis information and conceptual design criteria.

8.2.1 Bradley Man Camp Dumps Removal

The key consideration for design of the removal action is to work from upstream to downstream, and to prioritize removal of materials in the streambank and floodplain. Logistical and operational considerations were also important design criteria for the removal action, including optimal equipment sizing, haulage routes and excavation phasing.

The assumed dry density of waste materials for planning the removal activities is 110 pcf, which was applied to sectional volumetric estimates of the dumps to determine tonnages of removal phases. This density will allow for the RAO to be met within the planned excavation volume.

8.2.2 Repository

Initial engineering design criteria were established for this TCRA in the ASAOC (EPA and USDA-FS, 2021) and are defined as performance standards that must be met. The on-site repository will be located on the On/Off Leach Pads and will be designed to contain 25,000 tons of lower Meadow Creek tailings and 200,000 tons of material from the Bradley Man Camp Dumps. The consolidated tailings and mine waste will be graded to have a minimum slope of 3% to minimize ponding with a maximum slope of 33%. The repository will be covered with a minimum of 18 inches of clean fill material stabilized with temporary and permanent erosion control measures.

Design parameters are qualitative, quantitative, physical, functional aspects, and/or operational objectives used in the design process to ensure project goals are achieved and the facility fulfills its intended use. They provide an initial basis for facility design but are subject to change as design is optimized, facility operations or conditions change, and/or new information/technology becomes available. Initial design parameters for the on-site repository are listed in Table 8 and these will be expanded appropriately in the detailed design packages.

Table 8-1 Repository Design Parameters

Parameter	Value	Source	Comments
General			
Construction Season	June through November		
Waste Characteristics			
Lower Meadow Creek Tailings Dry Density	100 pcf	Tierra Group	Assumed density based on site experience
Lower Meadow Creek Tailings Moisture Content	To be determined		
Bradley Man Camps Dump Dry Density	110 - 120 pcf	Tierra Group	Assumed density based on site and other experience
Bradley Man Camps Dump Moisture Content	To be determined		
Repository Construction			
Side Slopes	3H:1V		
Minimum Repository Crest Width	50 feet		
Stormwater Management	100-year, 24-hour NRCS Type II design storm for BMP and stormwater channel sizing		
Liner system	Use existing On/Off Leach Pads	ASAOC	
Cover System			
Cover System	Cover with geomembrane liner		
Revegetation	To be determined – if required		Perennial native seed mix

NOTES:
ASAOC = Administrative Settlement Agreement and Order on Consent
BMP = Best management practices
NRCS = Natural Resources Conservation Service
pcf = Pounds per cubic foot

8.3 REMOVAL ACTION TECHNOLOGIES AND CONCEPTUAL DESIGN INFORMATION

The dumps will be mined in six continuous phases requiring approximately 3 months to prepare the site and transfer the material (**Error! Reference source not found.**). Additional time will be required to reclaim the site once the legacy d ump material is removed.

8.3.1 Technologies for the Bradley Man Cap Dump Removal

Access to the dumps will require reopening a 2,500-foot (0.5 mile) section of historical haul road that is approximately 45 feet wide with potential locations for further widening to allow haul equipment to pass safely (Figure 8-1). The alternate access route is too steep for heavy truck traffic. The total average round-trip haul distance from the dumps to the repository is approximately 12,500 feet (2.4 miles). Excavation of the dumps would progress upstream to downstream for all material between the historical haul road and the EFSFSR. The dump material within the historical haul road would be excavated downstream to upstream as the equipment retreats from the dump area to accommodate erosion control and site reclamation. The excavation phasing is shown in Figure 8-2.

The site preparation and excavation portion of this project is expected to require approximately 10 weeks based on an average production rate of 390 tons per hour, 9.6 operating hours per day (based on 80% utilization for 12-hour shift), and 7 operating days per week. This schedule utilizes a single excavator, a fleet of approximately four 40-ton articulated dump trucks, support equipment, and includes one week of preparation to reopen the historic haul road and establish erosion control structures.

Perpetua anticipates that miscellaneous building foundations and debris may be encountered during excavation of the dumps based on their historical use for a sawmill, man camps, and septic drain field (Section 3.1). Any debris encountered will not be segregated from the mine waste and will be hauled to the on-site repository for disposal.

Material drying strategies would reduce placement of saturated material in the repository when/if these materials are encountered in the removal area. Most of the dumps are anticipated to be above the water table but it is possible that the lower areas may be below the water table seasonally. Potential drying strategies could include:

- In-situ enhanced atmospheric drying, which would involve ripping of material in place to enhance drying prior to removal.
- Double handling and stockpiling of saturated materials in the excavation area to allow for drying prior to hauling.
- Drying of materials on the repository involving placement of material in thin lifts on a dedicated area of facility.
- Mixing of wet and dry materials to achieve acceptable moisture content.
- Potential strategies to reduce moisture content of existing materials in the repository such as pre-construction season temporary polypropylene cover on all or part of the existing facility.

Table 8-2 Bradley Camp Dump Phases

Phase	Acres	Volume (m^3)	Volume (CY)	Metric Tonnes	Imp. (Tons)	Prod. (Days)
Prep	2.30	n/a	n/a	n/a	n/a	5
1	1.86	21,616	28,273	37,828	41,698	11
2	0.73	7,081	9,262	12,392	13,660	4
3	1.86	19,880	26,002	34,790	38,349	11
4	1.98	29,606	38,723	51,811	57,111	16
5	2.44	20,606	26,952	36,061	39,750	11
6	0.78	5,836	7,633	10,213	11,258	4
Cover and Revegetate	11.5	n/a				10
Total	**9.65**	**104,625**	**136,844**	**183,094**	**201,826**	**72**

NOTES:
CY = Cubic yards
M^3 = Cubic meters
n/a = Not applicable

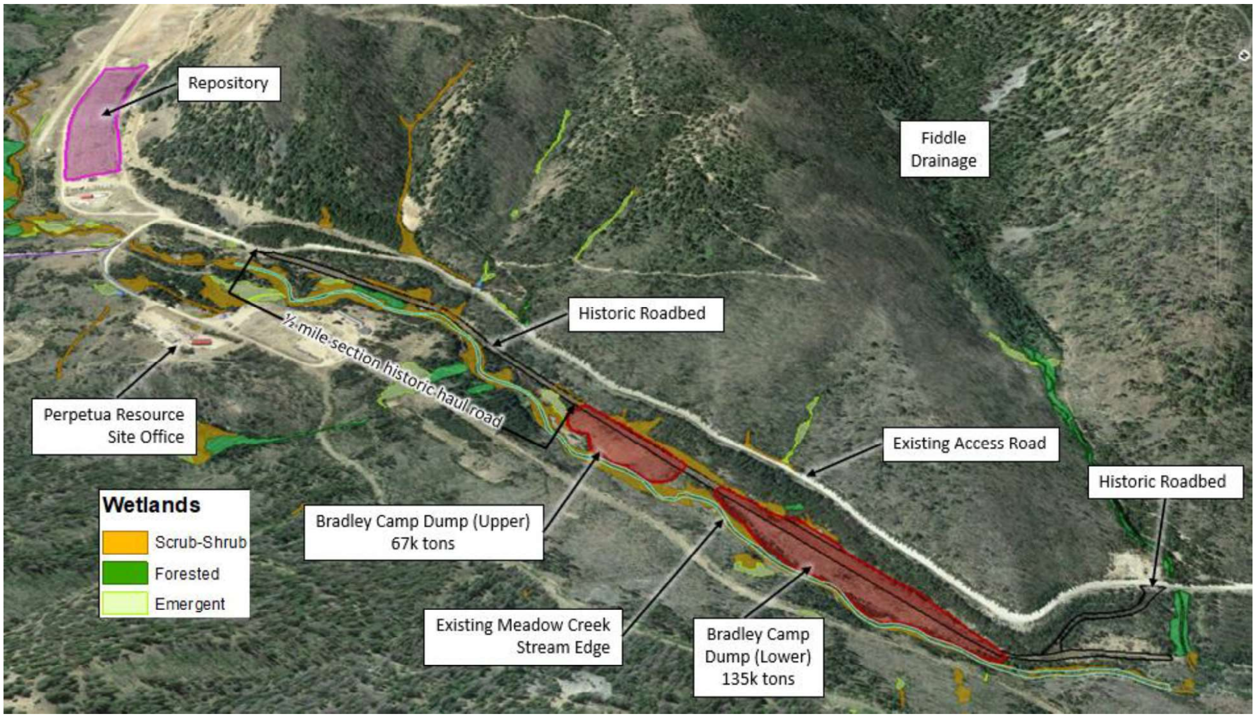

Figure 8-1 Bradley Camp Dump Access

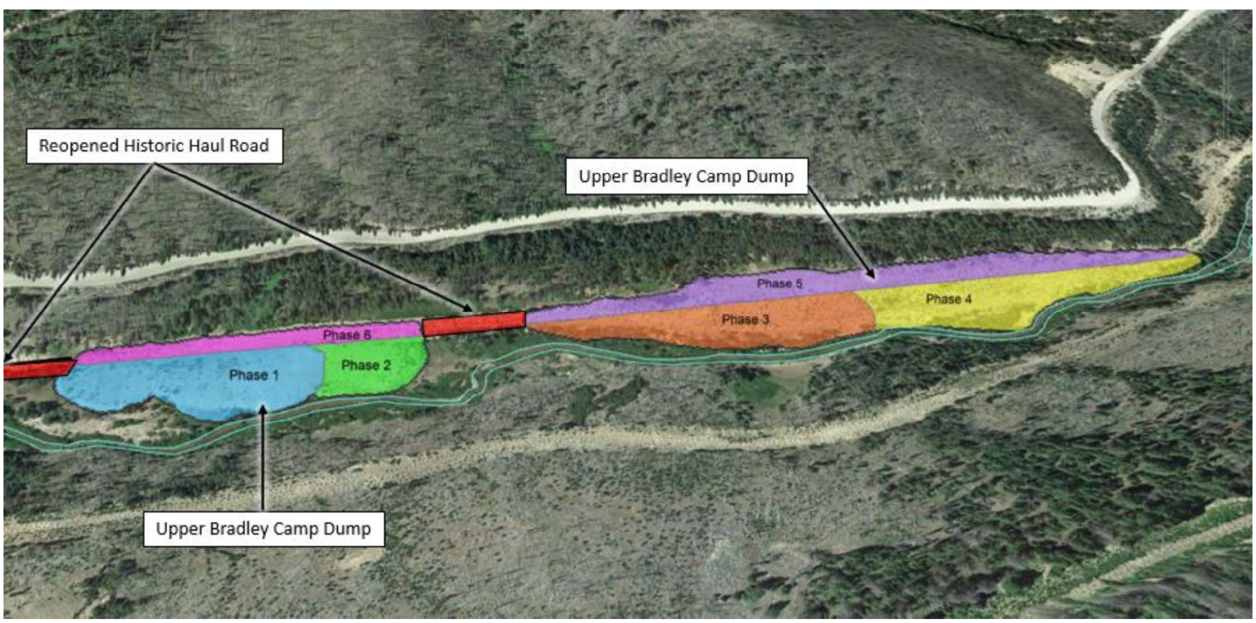

Figure 8-2 Bradley Camp Dump Removal Sequence

8.3.2 Repository Technologies

Cover systems including a geosynthetic component (HDPE/LLDPE liner) rely on the low permeability of the geosynthetic component to limit infiltration into the underlying mine waste. Drainage layers consisting of coarse-grained material or geocomposite overlying the geosynthetic component further reduces infiltration by directing water off the geosynthetic component away from the repository.

Erosion control will rely on vegetation (a mix of native perennials) to stabilize the cover surface and reduce erosion and use of a coarse gravel may also be considered. Standard best management practices (BMPs), such as mulching and coir rolls, would be utilized to control runoff and erosion until vegetation is fully stablished on the cover surface.

Strategies considered for treatment of leachate for incorporation into certain alternatives entailing leachate collection and management include both active treatment and passive treatment technologies utilizing sorption media for treatment of arsenic and antimony. Passive treatment technologies, such as vertical flow wetlands and bioreactors, while previously applied on site (keyway wetland) and effective at reducing constituent concentrations, may not be able to reliably meet all discharge water quality criteria. Active treatment approaches that are commonly used for arsenic removal in drinking water and groundwater remediation will be considered. Potentially applicable active treatment approaches include iron coagulation and filtration systems and deep bed adsorption systems that use zero valent iron, granular ferric oxide-hydroxide (e.g., Bayoxide E33,) or zirconium oxide (e.g., Isolux). Waste stream management approaches for active treatment systems include sludge dewatering and stabilization for solid residuals from coagulation and filtration systems, recycling systems for backwash from adsorption media, and solid waste disposal for non-reactive spent sorption media.

8.3.3 General Repository Design

The on-site repository will be constructed on the existing On/Off Leach Pads. As shown in the preliminary design drawings for the repository (Appendix A), approximately 25,000 tons of lower Meadow Creek tailings will be placed within a bermed containment area located at the southwest end of the On/Off Leach Pads. Approximately 200,000 tons of waste rock from the Bradley Man Camp Dumps will also be placed on the On/Off Leach Pads and will encapsulate the lower Meadow Creek tailings.

The repository will utilize the existing On/Off Leach Pads lined foundation. The foundation consists of (top to bottom) fill material previously placed over the On/Off Leach Pads, 3 inches of asphaltic concrete with a seamless thermoplastic seal coat, 12 inches of ¾-inch crushed base rock, and a continuous PVC subliner over a polypropylene non-woven, geotextile fabric. Tailings and waste rock will be placed in lifts, with the lift height determined during testing to achieve adequate compaction. After material placement, spreading, and leveling to the appropriate lift thickness, tailings and waste rock will be uniformly compacted.

The repository will contain tailings in the southwestern corner of the facility in a cell measuring approximately 300 feet long by 150 feet wide by 23 feet tall with 2:1 slopes and a crest measuring 50 feet wide (Appendix A, Sheet 1). The overall facility, once completed, will be approximately 1,550 feet long by 200 feet wide by 25 feet tall with 3:1 slopes and a crest measuring 50 feet wide (Appendix A, Sheet 3).

In future design phases, the repository cross-sections will be modeled using industry-accepted slope stability software to confirm long-term stability. Stability modeling will consider both static and pseudo-static conditions to evaluate facility performance under potential earthquake loading. The repository foundation integrity will be analyzed by determining the additional loading on the On/Off Leach Pad liner system. The total load will be compared to design assumptions described in the On/Off Leach Pad design report (Hovater-Way Engineers, Inc., 1981). The proposed loading will also be analyzed to ensure that differential settlement will not impact liner integrity.

8.4 RESOURCE PROTECTION PROCEDURES

Perpetua developed an Environmental Protection Plan (EPP) to detail overarching measures that will be implemented during removal actions at the Site to ensure protection of human health and the environment. Performance standards and BMPs included in the EPP apply to all phases of the ASAOC implementation (Appendix B). In addition, the removal action and repository facility will incorporate site specific resource protections. The following provides a description of these procedures and environmental protections specific to this removal action; these are also summarized in the EPP under site-specific resource protection procedures.

8.4.1 Bradley Man Camp Dumps Resource Protection

Key environmental considerations and/or procedures for the removal of the Bradley Camp Dumps are the protection of the EFSFSR, safe traffic transport and equipment operations, project sequencing, and surface water management. Portions of the Bradley Man Camp Dumps lie directly adjacent to the west bank of the EFSFSR (Figure 2-1). Where removal actions are near the river, BMPs to inhibit migration of sediment into the river (as outlined in the EPP) and roll out protections will be utilized. This includes physical barriers or trenching as necessary to prevent material from rolling downslope into the river. Material will be pulled, rather than pushed, away from the riverbank whenever possible. Equipment will not enter the water column and material, or equipment staging, will not occur within 150 feet of the EFSFSR, where practicable.

The haul route will include a portion of NF-412 from its intersection with the historical haul road to the On/Off Leach Pads. NF-412 is a public access route. To ensure safety and prevent potential spills due to traffic congestion, caution will be exercised in the form of warning signs, radio communication between equipment operators, operator briefings, and flagging, as necessary. Any potential, unforeseen safety hazards resulting from hauling operations will be immediately remedied.

Sequencing the removal actions into phases will enable excavation to progress upstream to downstream for all material adjacent to the EFSFSR. Excavation of the historical haul road will occur in the final phases and proceed as equipment retreats to accommodate erosion control and site reclamation. Site reclamation in the form of seeding and mulching will occur as soon as a phase has been completed. Erosion controls will remain in place until vegetation is re-established. Wherever possible a vegetated buffer will be retained between the EFSRSR and the excavation areas.

The EFSFSR is deeply incised in the reach adjacent to the Bradley Man Camp Dumps and removal actions are not anticipated to require water management. The removal action will be scheduled during the dry part of the year as much as practicable to further ensure that work will be conducted in dry conditions. Should water management be required, water will be pumped to the uncompleted work area (phase) most distant from the current removal site for land application for infiltration into portions of the dumps yet to be removed. Temporary coffer dams or sumps will be installed as necessary to isolate the water source. Wet material would be staged separately within an unfinished portion or phase of the removal area for drying before being hauled to the repository, or subject to other strategies as discussed in Section 8.3.2.

8.4.2 Repository Resource Protection

Key environmental considerations and/or procedures for the repository are the foundation lining, surface water management, and material placement and management. The repository will utilize the existing On/Off Leach Pads lined foundation. The On/Off Leach Pads were designed to consist of fill material, sealed asphaltic concrete, crushed base rock, and a continuous PVC subliner over a geotextile fabric. Validation of the construction of the existing liner system is a goal of the field investigation. This repository foundation is unlikely to allow significant leaching to the underlying natural soil, due to presence of a drain layer above the PVC subliner, which itself overlays low permeability tailings. The repository foundation integrity will be analyzed to ensure that differential settlement will not impact liner integrity. However, the integrity of the asphalt liner is unknown, and investigations may not be technically feasible to assess the liner with any accuracy without damaging the liner itself. Because of this uncertainty, leachate collection and treatment are included in the selected design for the repository at this time to prevent further contamination of groundwater in the uppermost aquifer, unless it can be demonstrated that this is not necessary, based on additional investigations and analysis of potential leachate generation, during development of the design.

The active disturbance areas of the repository will be bermed or silt fence will be used to prevent offsite migration of sediment, and sediment traps will be included as needed at the outlet of stormwater channels. Offsite stormwater will be redirected around the repository via existing perimeter channels or new channels excavated into native ground and stabilized against erosion.

Material will be placed in the repository in lifts, with the lift height determined during testing to achieve adequate compaction. After material placement, spreading, and leveling to the appropriate lift thickness, tailings and waste rock will be uniformly compacted. A grading plan has been developed to accommodate approximately 225,000 tons of rock and tailings with an 18-inch cover. The repository will be encapsulated by an engineered cover designed to reduce infiltration of meteoric water, the specific design of which is the subject of Section 9.

Dust will be controlled at the repository as necessary with water sprinkling. The tailings cell of the repository (southwest corner) will also be covered as soon as practicable with waste rock once maximum height is achieved. Slopes will not exceed 3:1 (H:V). Erosion and sediment controls will be incorporated into the final cover design as appropriate.

After construction, repository integrity will be inspected and maintained to ensure damage such as erosion, settlement, vandalism, burrowing animals, or other issues are identified and corrected and to manage leachate if the design entails this aspect.

9 SCHEDULE FOR PREFERRED REMOVAL ACTION

The removal action and repository construction are proposed to occur in 2022, initiating once snow conditions and vehicular weight restrictions allow mobilization of equipment to the Site. An estimated schedule for the removal activities is summarized below:

- Contractor Procurement: December 1, 2021, to April 1, 2022.
- Mobilization: May 25 to June 1, 2022.
- Site Preparation: June 1 to June 5, 2022.
- Construction: June 6 to October 1, 2022.
- Demobilization: October 1 to October 5, 2022.

Key to meeting this schedule is the following:

- Approval of this work plan by EPA and the Forest Service by September 2021.
- Field investigations to fill data gaps will not require permits prior to proceeding, including road re-opening to access the dumps and borrow source investigation areas.
- Agency approval of final designs for the removal action and repository will be completed by February 2022.
- The lead agencies will complete the formal consultation process to obtain a Biological Opinion from the fisheries agencies prior to contractor procurement, if required.
- Construction contractors are available summer of 2022 and bids to complete the work will be determined to be reasonable and generally in-line with engineers' estimates.
- No unusual wastes (non-mine) are encountered during construction that would require special treatment as hazardous.
- Suitable borrow materials can be obtained on-site.

10 PROCEDURES FOR PROCESSING DESIGN CHANGES & AGENCY APPROVALS

In the event that changes to the final design of the preferred removal action alternative are necessary, the changes will be documented with Engineering Change Orders (ECOs) and submitted to the Agencies for review and approval prior to construction and for change orders prepared during construction. The ECOs will describe the proposed design change(s), provide justification for the change(s), and summarize the benefits of the proposed change(s). Agency comments will be incorporate on the ECO (if any), and a final ECO will be issued for Agency signature. Perpetua will work with the Agency representative(s) to collaboratively resolve any substantive design changes identified as necessary during the construction process.

11 PROCEDURES FOR COMPLYING WITH EPA'S OFF-SITE RULE

The Off-Site Rule (40 Code of Federal Regulations 300.440) applies to any removal action involving the off-site transfer of any hazardous substance, or pollutant or contaminant (CERCLA wastes) pursuant to the ASAOC as set forth in Sections 2.5.1, 2.5.2, and 2.5.3 of the SOW (EPA and USDA-FS, 2021). Once a CERCLA waste has been identified, Perpetua will select a disposal facility and coordinate with EPA Region 10 regarding compliance with the Off-Site Rule. EPA Region 10 will use the compliance criteria and release criteria established in the Off-Site Rule to determine the acceptability of the facility selected for disposal of any such wastes. No off-site disposal is proposed under the removal actions.

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Appendix A Preliminary Engineering Design Documents

Appendix B Environmental Protection Plan

Appendix C Historical On/Off Leach Pad Design